Electrical World

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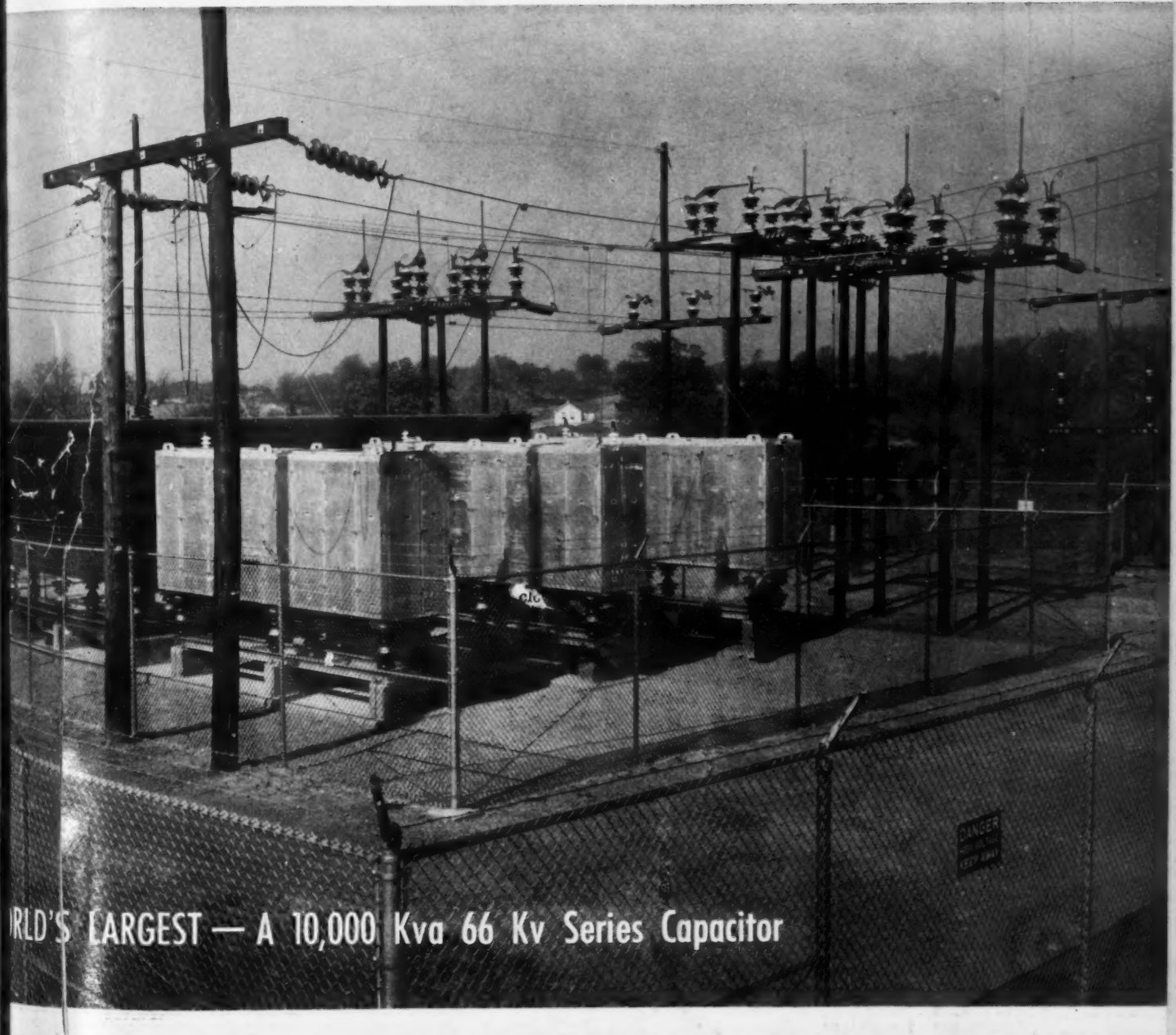

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FEBRUARY 14, 1948

Features

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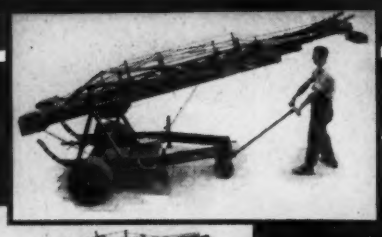
Technical Report on AIEE Convention
Store Illumination to 1-3-5-10 Formula
Short Circuit Tests on Corroded Connectors



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February 14, 1948

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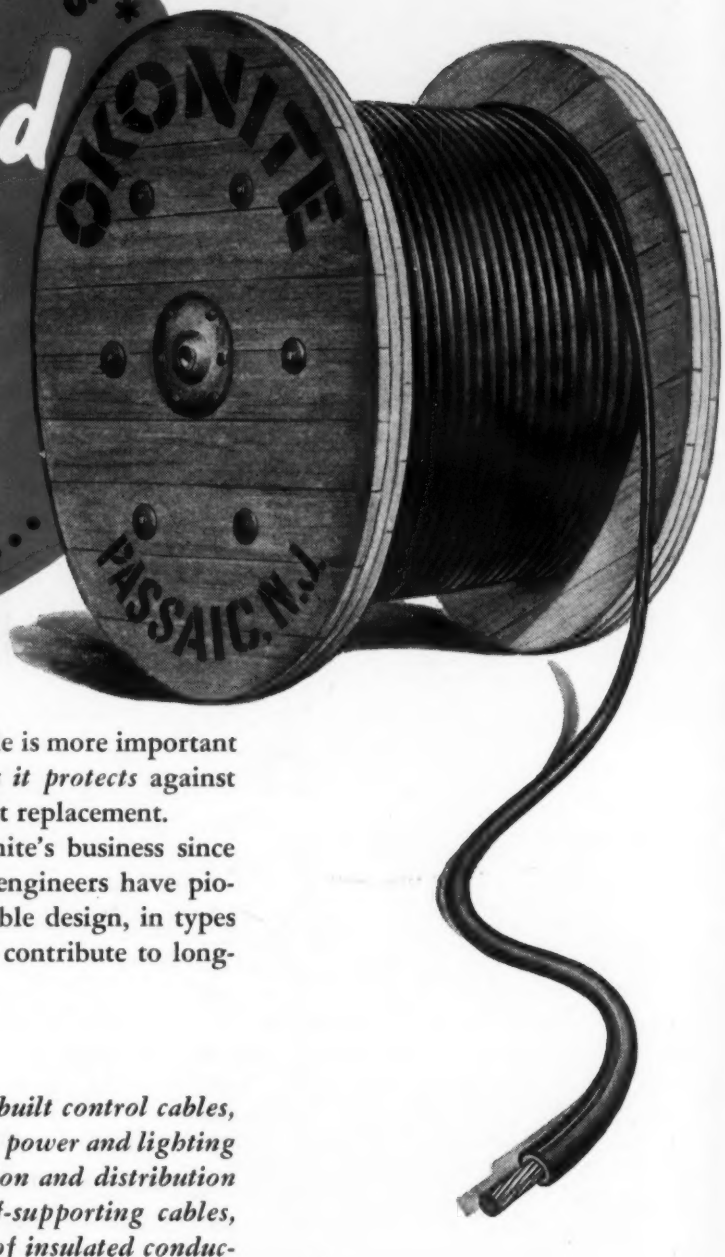

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Electrical World — Editorials

FEBRUARY 14, 1948

The Dimensions of 1948

"MAN OF THE YEAR" for the electric power industry during 1947 was the operator. Who will be 1948's "Man of the Year?" It appears that honor will fall to the industry's financial man. Everyone knows the operator needs —and is getting—a lot of new plant. And everyone is becoming increasingly aware that it will take fabulous sums of money to pay for it.

It isn't really a question of WHETHER the industry will be able to raise the funds. They must be had because the equipment must be had. The equipment must be had because the American public wants more and more electric service. Does anyone imagine that the capital requirements of such electric service will not be met?

As a matter of fact, if the electric utility business has feared nationalization—and how it has —it previously has had virtually no cause for alarm compared with that which it now must face. Nationalization of such an industry, in such a nation, is a difficult proposition. Some experts tried, for 15 years, with about 10 percent success. Perhaps the main reason they failed has been that, despite abuses, the electric power industry was doing its job. It was rendering good service. It was keeping capability ahead of the load. It was advancing the art. It was lowering rates. Nationalization of an industry with such a record always will be hard.

Therein lies today's problem. Let the industry fail to maintain this record and its main bar to nationalization is gone. Let it go in for a generation of increasing rates, ineffective service, stagnant technology, "too little and too late" power supply, and it has no valid political argument against nationalization.

What could lead the electric utility industry into such evil days? The failure to raise sufficient capital at manageable costs could do it. Insufficient capital would inevitably prevent power systems from keeping ahead of expanding load. It would force rates upward or credit downward. It would certainly end such experiments as Sporn's, at Brilliant, or the others which sparkle so brightly in the industry's record.

But having tasted the ultimate in electric service—and the U. S. customer has had just that through the years—John Public won't be content with less. Particularly, he won't be so long as a siren political song is sung to him by those who would nationalize power. "Is it a lack of investment capital which imperils your electric service, dear voter? Come to government. It has lots of money." Or perhaps it will be a campaign of righteous indignation. "We are determined that the life, health and safety of our people shall not suffer because greedy capital shirks its manifest duty to mankind. Government will do the job for you." In law, it has this right.

These, then, are the dimensions of the 1948 job. Government won't be much help. Already it has complicated this job. It will stand coldly by, entering the struggle only as a competitor. But it will instantly pick up the pieces if the industry drops anything. These are accurate, if unattractive, dimensions. We lay them out so baldly because we think the industry can do the job once it recognizes what's to be done.

★ ★ NEWS OF THE

Southwest Drought Brings Trouble to California Utility

Pacific Gas & Electric Pleads for Power Conservation—Pumping Loads Grow In Area States as Farmers Dig and Dig for Water—Slow Delivery of Generating Units a Factor

THE PACIFIC GAS & ELECTRIC CO last week (Feb 3) made an unprecedented plea to its customers to conserve power. Lack of rain and an unseasonal irrigation pumping load has brought about a severe emergency in California's power supply. Recent rains have brought some relief although they were "showers," not the "heavy" fall needed to bring any marked improvement.

James B. Black, president of the utility, stated that a "very serious power problem"—created by the water shortage, plus an inability of manufacturers to deliver generating equipment on schedule, plus a rapid growth in demand—will last for the next nine months.

Specifically, the company asked business to eliminate indoor and outdoor display lighting, factory consumers to cut use of electricity between 4 and 8 PM and to avoid power waste, farmers to stop use of irrigation pumps during the 4 to 8 PM period, and home users to use electric equipment only when essential.

Electric clocks throughout the company's service area have been slowed down by a drop in frequency to 59½ cycles, employed at peak periods to conserve power. The company estimates that a saving of approximately 60,000 kw is effected by the frequency change over a 12-hour period.

Black stated that his company was just now receiving the first large generating unit ordered in 1945. The 100,000-hp unit is expected to be in operation in the Kern plant, near Bakersfield, in April.

"Altogether 525,000 hp of new capacity will become available in company plants in the next 12 months," he said. This, plus some 200,000 hp at the Bureau of Reclamation's Shasta and Keswick projects, will total "more than twice the expected growth in power demand in this area."

Agriculture has suffered seriously in Nevada and Arizona as well as in Southern California. Field crops and range grass are most seriously affected. The result is excessive pumping from water tables that are already low. PG&E reported that electricity for pumping alone was 200,000 kw above normal.

Ground water supplies have been dropping at such an alarming rate in Arizona that a special session of the legislature has been called to draft a groundwater control law.

Early snows in Southern California mountains were washed away by December rains. Some places had snowpacks as much as 50 in. below normal before recent storms.

Some areas in this section have had not more than 20 percent of normal rainfall. Two cities, Ventura and Santa Barbara, have set up water rationing regulations that assess a $300 fine for use of water for other than household and sanitary purposes.

Los Angeles will not suffer from a lack of domestic supply since its reservoirs are at 56 percent of capacity. Most of its water comes from the Owens Valley. It can get more from the Colorado River where Hoover Dam has ample storage from precipitation in the upper basin states. San Diego is similarly protected, having recently tied up with the Metropolitan Water District with the completion of the San Diego aqueduct. The All-American Canal brings adequate water to the Imperial Valley.

Municipal supplies in Arizona also are adequate although the Southern part faces another tight water year. The Salt, San Carlos, and Gila River watersheds have had deficiency runoffs since 1940. Dams in the Salt River

LARGEST NEON-LIGHTED MURAL in the country is the claim made for this one in San Diego, Calif. It is 63 x 58 ft. More than 2,000 ft of cold-cathode neon tubing of various sizes were used. Some of the tubes are of two-color glass, one side illuminating the picture and the other turned outward. Browns and tans, rarely seen in neon lighting, are among the many colors used. The peon is 26½ ft tall. On the reverse side is the movie screen

Valley Water Users' Association chain have dangerously low levels. With a total capacity of 1,650,000 acre ft, they now have only 228,000, compared with last year's 426,000 acre ft.

At present snow packs in the state are about one-third of last year.

New Mexico, although still not up to normal, is better off than last year when the state had an abnormally low water year. The darkest spot is the Elephant Butte Irrigation District, where cuts in irrigation water allowances have been announced. The district's hydro plant was stopped in August, turning power generation responsibility over to the El Paso Electric Co's steam plants.

Larger cities in Central and Northern California have no domestic water supply problems. Smaller towns with no tie-in to larger systems are less well off.

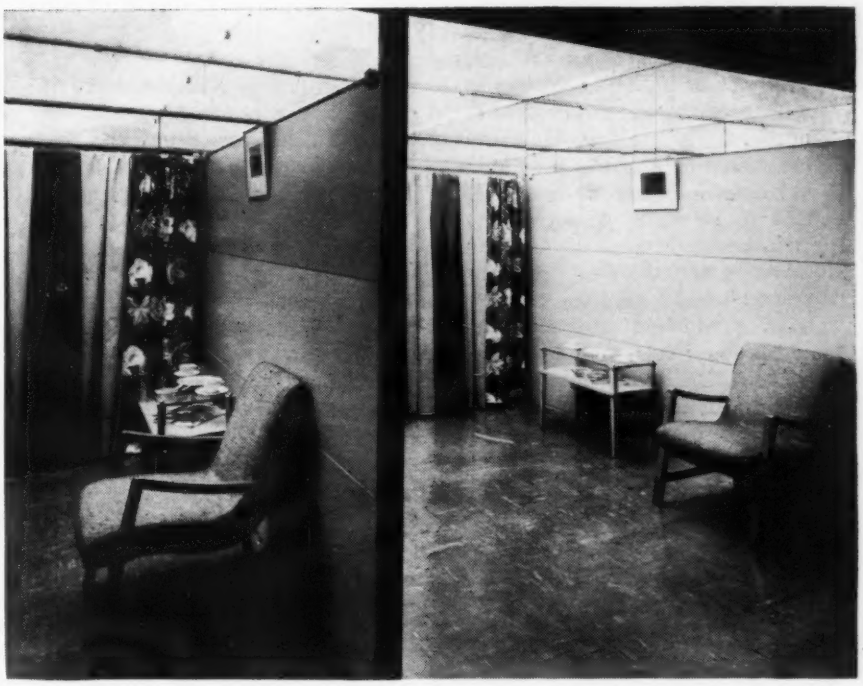
Vote Water Rationing

Up the bay from San Francisco, Benecia's City Council has voted water rationing with violators punishable by a $300 fine or 90 days in jail, or both. Herman Lake, serving the town, has only about 150,000,000 gal. Its capacity is 700,000,000.

The Sacramento Valley has no worries, as the same rain that last month flooded the Willamette Valley in Oregon added 600,000 acre ft to the Shasta Dam reservoir, bringing it to 2,730,000 acre ft, compared with 2,127,000 for last year. Lack of irrigation water is posing a threat to agriculture in the San Joaquin Valley. Friant Dam, back of Fresno, recently registered only 135,000 acre ft where 306,000 had been stored on the same date last year.

Oregon, Washington, Idaho, and Utah, have had close to their normal rains and snows. Water for electric power generation, irrigation, and domestic supply is adequate. The greatest problem in these states seems to be the construction of works to control floods and to supply enough hydro capacity.

Efforts to combat the drought in the Southwest have been serious and varied. Indian chiefs have been imported into Southern California from Oregon to appeal to the rain gods. A Los Angeles official suggested a $1,000,000 reward be offered to anyone who can find new sources of water for that city. Dry ice has been pumped into clouds to bring artificial rainfall with varying success. Law suits have been threatened against areas milking clouds that would otherwise have served adjacent sections. One irrigation district even filed for water rights in the clouds hovering over its territory. It is said that "every drill rig between the Pacific ocean and Texas" was busy reaching for water.



IDENTICAL in size, colors, and furnishings, these two rooms show the advantage of lighting through a "Polaply" ceiling (EW, Jan 31, Page 43). In room at left, the lighting is from direct sources above an open louver ceiling of the egg-crate type. In the other, lighting is through a "Polaply" ceiling. In the latter room, note the smooth, light appearance of the wall and the better definition of color and design in the furnishings. The rooms were set up at Lighting Center of Sylvania Electric Products, Inc, in New York

New Municipal Plant

Bryan, Tex., will build a 5,000-kw steam electric generating plant and will add another unit of the same size in 1954. The present diesel plant will be maintained for standby use. A tie-in with the Brazos River Transmission Electric Cooperative for peak power is also under consideration. The new plant will use natural gas for fuel.

NLRB Frowns on Small Unions Formed by Raiding

The International Association of Machinists (Ind) lost an attempt to get the National Labor Relations Board to carve out a small bargaining unit of garage mechanics of Illinois Power Co, Decatur, Ill., from a larger group represented since 1923 by the International Brotherhood of Electrical Workers, AFL.

In turn, NLRB refused to assist an IBEW raid on the CIO Mine, Mill & Smelter Workers at two Scoville Manufacturing Co plants in Waterbury and Waterville, Conn.

Union raiding practices have increased under the Taft-Hartley Act which forbids NLRB to deny a craft bargaining petition simply because it may have previously established a different bargaining unit.

In the Illinois Power case, NLRB decided it would be inappropriate to

create a unit of six garage mechanics in the company's Belleville, Wood River, and East St. Louis plants whom the IAM claimed to represent. Basis for the decision was that the unit was too limited and should be at least division-wide in scope.

The company agreed with IBEW that the appropriate unit is the comprehensive grouping of transmission and maintenance employees in the Southern Division's six plants, as are now covered by contract with IBEW. If the board found that garage mechanics could comprise a separate unit, the company felt it should be a system-wide unit.

At Scovill Manufacturing, IBEW sought to separate employees in the electrical construction and maintenance department and the steam department into a unit separate from the overall unit of production and maintenance employees now represented by the CIO union. NLRB found that the workers in the smaller unit sought by IBEW were not a craft group and, in fact, possessed a wide variation of skills.

•

REA Cleared by Senators; Accuser Fails to Appear

What has been billed as an expose of alleged improper practices by the Rural Electrification Administration turned into a virtual kissing bee this week—with REA getting the kisses.

The show was staged by a Senate Civil Service subcommittee, which met to hear expansion of charges hurled at the lending agency recently by Claude W. Eppard of Luverne, Minn, a former REA and co-op employee. Eppard was conspicuous by his absence.

Sen William Langer, chairman of the subcommittee, announced that Eppard was unwilling to appear unless paid for his transportation to Washington. The subcommittee felt it unnecessary to subpoena Eppard—the only method by which it could finance his trip—Langer reported.

Meanwhile, the subcommittee heard more than a dozen officials of REA-financed cooperatives, all of whom flatly denied Eppard's indictment that the agency was guilty of "political finagling" (EW, Jan 31, Page 33). At the close of the hearings Senator Langer termed these charges as "totally unfounded."

•

Alexander Maxwell Dies

Alexander Maxwell, retired director of engineering of the Edison Electric Institute, died Feb 10, at a hospital in Norwalk, Conn., after a long illness.

Power Politics Topsy-Turvy as BPA Plans for Future

Administrator Raver in Report Outlining Advance Program Blames Government for Power Shortage in Northwest and Asks Non-Federal Agencies to Add All Possible Capacity

THE TOPSY-TURVY POLITICS of the Pacific Northwest's electric power supply furnished new departures this week from the old pattern. Among them:

1. A government agency asked non-federal power suppliers to build all the capacity they can—now.

2. A government agency reiterated that a serious power shortage exists in the region now—and blamed it on Congress.

3. A government agency said its potential loads could double by 1951 and triple by 1956 if it had the power to meet them.

The government agency, of course, is the Bonneville Power Administration. The statements came in an annual report outlining the agency's advance program. Gist of the document was the recommendation that the federal government install 4,000,000 kw by the end of 1955, along with accompanying transmission facilities.

Such a program, the report held, would require "full and simultaneous development of non-federal power resources of the region." Even if both were prosecuted vigorously, BPA went on, the Northwest will be short of power until "at least 1954."

Declaring that the "Pacific Northwest faces a serious power shortage today," BPA Administrator Paul Raver said this was due to the failure to carry out federal construction programs recommended earlier by BPA. This failure, he said, came about "because money had not been available in sufficient volume.

"A critical power situation is certain to occur in the coming winter of 1948-49, with potential peak loads in the region exceeding generating capability by a quarter of a million kilowatts," Raver said. "The power requirements of the Pacific Northwest have more than doubled during the war years and promise to double again during the next six years. Potential loads of BPA could double by 1951, and increase three-fold by 1956, if sufficient power were available to make this possible."

To obtain the 4,000,000 additional federal kilowatts which BPA wants by the end of 1955, Raver declared it would be necessary to:

1. Install the 11 remaining generators at Grand Coulee.

2. Install initial generators at Hungry Horse, Albeni Falls, McNary, Foster Creek, Detroit, Meridian, Hills Creek, Lower Monumental, Anderson Ranch, Palisades, Lower and Upper Scriver, and Garden Valley dams. Of these 13 dams, five are under construction. They will begin generation in 1949, 1952, 1953, and 1954.

Wants Transmission Lines

Raver made the customary plea for additional transmission facilities and said the existing BPA network will be fully loaded on all its main segments this summer. Existing regional load centers will continue to be the main consuming areas in the foreseeable future, Raver declared. But, by 1956, additional centers should have developed in Southwestern Oregon, Southern Idaho, and Western Montana.

Substantial non-federal generating capacity is now planned for installation throughout the region. By 1950, 298,300 new kilowatts are to be in operation by private utilities. These include:

1. Idaho Power Co, 169,000 kw.
2. Pacific Power & Light Co, 45,000 kw.
3. Montana Power Co. 56,000 kw.
4. California-Oregon Power Co, 28,300.

Other non-federal installations by 1956 will raise the non-federal total to 753,800 kw, including:

1. Seattle, 420,000 kw at Skagit.
2. City of Eugene, Ore., 35,500 kw.

In addition, Tacoma is investigating hydro development on the Cowlitz River.

A Safe Place to Work

The employees of the Southwestern Gas & Electric Co on Dec 31, completed 14 consecutive months without a disabling accident. They had worked 2,012,958 man-hours without a lost-time injury. The last lost-time injury occurred Oct 22, 1946. The company employs over 850 persons in Louisiana, Texas, and Arkansas.

Reclamation Increases Power Project Plans to 2,948,100 Kw

June 30, 1953 Set as Completion Date—Krug Admits Plan Depends on Funds Alloted by Congress—Delta Steam Plant Part of Program—Columbia Basin to Get Biggest Project

A SUBSTANTIAL INCREASE in the Reclamation Bureau's plant construction program was announced last week (Feb 4) by Interior Secretary Krug. The Bureau now proposes to install 2,948,100 kw of generating capacity, mostly hydro, at Western river projects by June 30, 1953.

Included in this schedule is a 240,000 kw steam generating station proposed for the Delta area of California's Central Valley. As Krug pointed out, however, completion of the entire accelerated program hinges upon the construction rate "to be established by annual Congressional appropriations."

The proposed Delta steam plant has been included in the Bureau's Central Valley project plans for years. Former Secretary Ickes proposed to erect the plant at Antioch. The Bureau obtained an appropriation of $200,000 for preliminary design of the structure, which it claims is needed to firm up hydro power from Shasta and Keswick, and to furnish energy for irrigation pumping.

Reclamation plans installation of three 80,000 kw generating units at the site, one each in the fiscal years, 1951, '52 and '53. Bureau spokesmen said the exact location of the plant has not been chosen but that it would be near Delta.

The new construction schedule represents a general step-up of the six-year power program announced by the Bureau last spring. Then the agency proposed the addition of 2,269,600 kw of capacity on Reclamation projects by June 30, 1952.

In addition, the Bureau reported it had scheduled an additional 1,829,000 kw for completion after 1953. This would bring the total ultimate capacity of Bureau plants and those whose energy output is to be marketed by that agency to 6,915,237 kw.

Largest additions scheduled for a single project are slated under the new schedule for the Columbia Basin, where 1,296,000 kw in new capacity will be added in the fiscal years 1948-52. Other big additions include a total of 300,000 kw to be installed at the Hungry Horse project, Montana, in fiscal 1952 and '53. Another 154,300 kw will be added in seven plants on the Colorado-Big Thompson project, 53,100 kw in 1950 and 101,200 kw in 1952. New units at Davis Dam will provide 90,000 kw additional capacity in 1950 and 135,000 kw in 1952, completing the power installation of that project.

Secretary Krug urged full-speed construction of these facilities as a fuel conservation move, estimating that they would provide 'the energy equivalent of 30 to 40 million barrels of oil a year."

"Though hydro plants are generally a source of lower cost energy," he asserted, "the fact that they take longer to build has resulted in a stimulation of increased steam plant construction, despite the shortage of fuels and soaring fuel prices. Increased fuel costs are causing the spread between steam and hydro power costs to be widened still more.

"People . . . are becoming conscious that the oil shortage is a fact and not an opinion. Even the experts were jolted when fuel oil prices for steam electric plants practically doubled within the past year to the present price of $2.25 to $2.50 per barrel. Undoubtedly, many of the new steam plants being built . . . will become largely stand-by for meeting peak loads or other emergencies as the lower cost hydroelectric power becomes available in the future."

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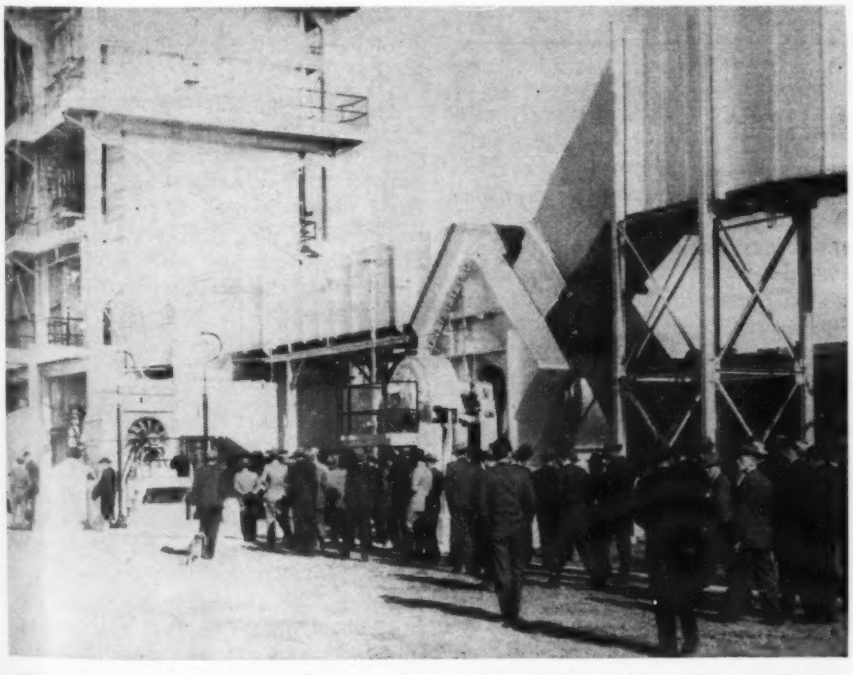

OFF FOR A TOUR through the Cecil Lynch Plant of the Arkansas Power & Light Co are 175 employees of the utility who have completed five-year periods of service. The trip was part of the program at the annual awards party

Municipal House Heating Rates Forbidden to Utility

The Puget Sound Power & Light Co, Seattle, has been denied permission by the Washington State Department of Public Utilities to establish the same rates for electrical heating that had been set up last year by Seattle City Light. (EW, Aug 2, Page 52).

Andrew J. Zimmerman, director of the department, declared that the proposed rates would establish a "differential between present and future house heating consumers, which is contrary to the spirit of existing statutes," and that "the company failed to establish necessity for increased revenue on the basis of its entire financial problem.

Rates on equipment installed before Jan 1 1947, would have remained unchanged until 1952 under Puget Power's proposal, in accordance with a pattern established by City Light. The municipal system, however, is not under the jurisdiction of the state department.

In the event increased home heating should impose an "abnormal demand" upon the company's facilities, Puget Power may file a new application with the department, the order said.

Cold Weather in March, Floods in April, McCormack (He's Right So Far) Predicts

If you think we've had a tough winter so far—and who doesn't—get set for "an intense cold wave" starting on or about Feb. 29. It will be followed in spring by severe floods.

This is the warning which has been given Public Service Electric & Gas Co, Newark, N. J. Public Service has every reason to listen. Its informant, George J. McCormack, called that Christmas night—Dec 26 storm which still has the natives on their heels in the New York metropolitan area.

McCormack, a statistician by trade, has spent a generation studying major and minor weather cycles. Out of it, he has developed a theory which holds that certain extremes of weather which occur in one region during one season will re-appear the following year approximately 80 to 87 deg westward in terrestrial longitude. A quick, loose check on the theory may be had by recalling last winter in England and the continent—one of the most severe in years. This winter's U. S. cold wave has centered somewhere near points 80 and 87 deg west of Greenwich.

McCormack, whose advice goes to a number of other utilities in the New York metropolitan area, turned loose an interesting long-range prediction last Aug 18. Beginning with Christmas, he warned, the winter of 1947-48 "is indicated as being the most severe in 30 years . . ." Effective areas of this prediction, he said, would be from Nebraska and Missouri eastward. On last Sept 22, he circulated another letter suggesting that ". . . movements of fuel oil and coal should be planned so that excess supplies may be stored in Eastern stock piles before Dec 22, as safeguards against delays in transit after that date." Suburban New Yorkers comment on that one ruefully, asking why McCormack didn't suggest the stockpiling of a few spare distribution systems, which certainly could have been used in the New Year's ice storm.

"One of the most intense cold waves of the winter," McCormack went on, "may be expected to originate Feb 29 north of Toronto and sweep south and eastward through the first four days of March.

"During the spring of 1948, the Middle Atlantic and Eastern states may experience an aftermath of accumulated snow and ice over northern areas after a severe winter. With a thaw setting in suddenly under gentle southerly winds on and immediately following April 1, inundations of the Ohio, Monongahela, Allegheny, Susquehanna, Genesee, Connecticut, and other eastern waterways may be anticipated."

This cheerful outlook isn't all McCormack sees, but it's enough for one installment. We'll give you the rest of the bad news if he's as right about these as he was about the Christmas storm.

St Lawrence Senate Vote Set for Feb 27; Foes Lead

With the final vote set for Feb 27, the Senate debate on the St Lawrence Seaway and Power project settled into a desultory exchange of claims and denials this week.

Both sides expressed confidence, but opponents of the resolution approving an agreement with Canada to build the project were conceded to have a probable edge. This margin first became apparent last week when the opposition succeeded in preventing the vote sought by proponents.

It was agreed that no amendments of the resolution would be submitted after Feb 23 and that a vote to return the legislation to committee for further hearings would follow two days later. Thus opponents get two chances—on Feb 25 and 27—to stop further floor action on the measure.

Non-partisan division over the issue continued. Among the Senators speaking against the proposal were Republicans Lodge, Saltonstall, Butler, Taft, and Ives, and Democrats Overton, Tydings, George, McClellan, O'Daniel and O'Conor. The proponents included Republicans Ferguson, Wiley, Aiken, Vandenberg and Tobey, and Democrats Barkley, Thomas of Utah, and Wagner.

Mild surprise was occasioned by the objections of Senators Taft and Ives. Taft, who previously had refused to commit himself on the project, said he was opposed to further large increases in public works spending at this time. He termed the Seaway's economic and defense values as "questionable," but described the proposed power development as "important and desirable."

Senator Ives took much the same stand and proposed that a treaty be drawn with Canada to provide for construction of the power facilities alone by the state of New York and the province of Ontario.

Central Arizona Project Given Reclamation Okay

The Bureau of Reclamation took a deep breath last week, then plunged into the bitter seven-state controversy over development of the Colorado River.

Result was a Bureau report, approved by Secretary Krug on Feb 5, which called for construction of the Central Arizona Reclamation project. Under this proposal, the agency would spend an estimated $738,408,000 on construction to develop 770,100 kw of hydroelectric energy and provide "supplemental" irrigation water for 640,000 acres of Arizona lands.

The report, which was sent to the Colorado Basin state governors for comment before its submission to Congress, is expected to touch off an explosive row. California is expected to protest vigorously, as it has in the past, against further use of Colorado River water in Arizona. However, a substantial portion of the power produced will benefit the Southern California area, Bureau spokesmen predicted.

Included in the report is the multipurpose Bridge Canyon Dam with its proposed 750,000-kw power installation. Though widely separated from other Central Arizona project works, it was made part of the development, Bureau officials said, to provide revenues necessary for repayment of project costs.

Other power installations will be at Horseshoe Dam on the Verde River, Buttes Dam on the Gilda, and McDowell Dam on the Salt. The Horseshoe Dam will be enlarged and a 10,000-kw power plant added. The Buttes Plant will have an installed capacity of 6,000 kw and a 4,100-kw plant is planned for McDowell Dam.

Though detailed plans for transmission lines from these projects are incomplete, the Bureau expects to interconnect them with its other Colorado River plants, as well as to intertie all the proposed plants. New transmission lines also "probably" will be built into California and to Arizona load centers, it was reported.

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Los Angeles Gives Raise

The Los Angeles Water & Power Commission Jan 30 approved wage increases of 5 percent for employees earning $500 or less a month. Labor organizations representing electrical workers, engineers, and architects had asked for 15 percent increases for engineering employees and a $25 a month for all others. The increases add an estimated $104,487 to the municipal department's payroll.

Doble Clients Learn of Gains Made in Field of Insulation

200 Engineers Attend Conference at Boston—Prevention of Equipment and Service Failures Stressed—New Type of Communication For Use on Transmission Systems Is Shown

INSULATION ENGINEERING advances in techniques, scope and test refinements toward higher economic levels as regular symposia occur. The Doble Engineering Co's annual nation-wide conference of clients, Feb 2-6, illustrated this trend.

The conference objective was prevention of equipment and service failures on power systems of all types and characteristics. The economic evaluation of modern test programs, progress in the understanding of liquid insulation, better interpretation of field tests, and a notable advance in communication methods were of outstanding interest. A visit to the company's new laboratory and headquarters in Belmont, Mass., climaxed the conference at which 200 engineers were present.

Electric utility men were shown the operation of a new type of communication for use on transmission systems. Two carrier systems (for use at any voltage) were tied together acoustically by two separate mechanically insulated channels without electrical coupling.

President Frank C. Doble stated that the power-factor test of insulation is now thoroughly accepted as adequate for routine work, special maintenance, and investigations. Ten years' research in oil testing has now fully established the reliability of the methods employed. Marked advances have been made in water extraction methods and controls. Manufacturers of electrical equipment, as well as users, are now adopting these effective means of study. The laboratory and the field have come into intimate coordinative relationship. Decades of experience have borne fruit in more accurate interpretation of test practices.

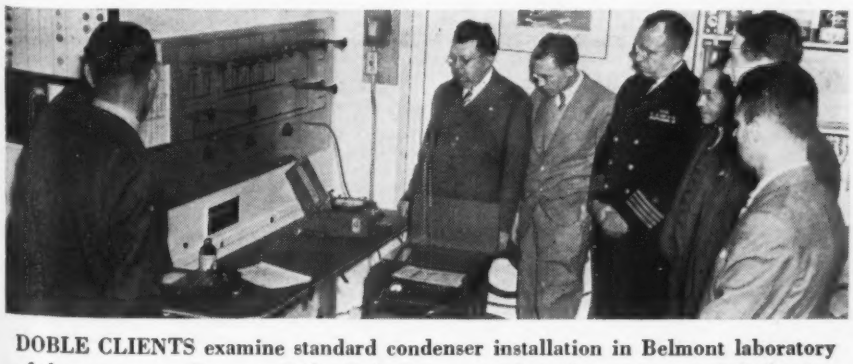
Nearly 36 papers and reports featured the sessions. It was brought out that more study is needed to determine the economic field of capacitor testing schedules. One client stated that an analysis of the cost of testing circuit breakers and transformers saved $50,000 net a year. Another reported $20,000 annual savings alone from periodic testing by the power-factor method.

A new method of testing bushings was noted. Manufacturers have engineered features in bushing design in the way of special test and terminal facilities. This has been in co-operation with the Doble organization. The trend is toward testing sections of insulation without disconnecting component parts of the apparatus. Test techniques and field results have been reviewed for more accurate determination of periodic scheduling of internal check-ups. Deeper studies of corrosion and corona problems are under way. Mitigation of surface leakage is a primary objective.

Investigation shows that the relationship between power-factor and temperature varies between good and poor bushings. Zonal limits are narrower with good bushings. Another speaker emphasized the increasing importance of control cable tests. Such cables are often neglected over the years on the assumption that nothing will happen to them. Their vital part in plant and system operation was vigorously stressed. Power cables within stations were also cited as essential subjects for periodic testing.

Three clients reported using the cathode ray oscilloscope in identifying corona losses in bushings of dry-type current transformers. Others urged that manufacturers provide in their designs facilities for enabling tests to be made on network transformers. One company has changed its specifications to accomplish this.

Power-factor data on 190 classifications of instrument transformers and embodying many hundred of field tests were submitted by a Doble staff member as a guide of practice ranges for client benefit. It was noted in the general transformer session that interest was increasing in relation to possible standardization of bolt circles for bushing layouts. One operator reported development of an inexpensive breather for smaller power transformers. It was stated also that one company has established a technique for testing potheads without breaking the cable sheath, and independently of cable lengths.



DOBLE CLIENTS examine standard condenser installation in Belmont laboratory of the company. Group includes J. O. Long, rear left, Dayton Power & Light Co; R. Beatty, Union Electric Co of Missouri; Capt H. F. Dodson, USN; J. H. Moore, United Illuminating Co, New Haven, Conn.; and at the extreme right, E. G. Hobbs, Public Service Co of Oklahoma

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Kennecott Copper Power Station Nears Completion

Work is nearing completion on a $12,000,000 addition to the power plant of Kennecott Copper Corp, located near the corporation's Magna, Utah, mill.

Largest single addition to the corporation's facilities in recent years, the project was started in February, 1942. Slow delivery of equipment has delayed completion.

Latest addition, consisting of two 25,000-kw turbo generators and another boiler with auxiliary equipment, is complete except for installation of coal-burning equipment, expected early next fall, to serve the third boiler.

The completed plant has an installed generator capacity of 100,000-kw. It is one of the largest industrially owned power stations in the West.

Generating equipment consists of one 50,000-kw generator, which went into operation in 1944, and the two 25,000-kw generators. The large unit and one smaller unit will be used regularly while the other small unit will be for standby use. The plant has its own coal pulverizers, boilers which can burn either coal or natural gas, condensers, and auxiliary equipment.

It was built to furnish electrical power to the company's open pit mine at Bingham, the new Copperton electrified rail line, and the Arthur and Magna mills.

Energy Sales Increased 10.6 Percent in November

Sales of electric energy to ultimate customers in Nov, 1947, totaled 18,726,158,000 kwhr. This was a 10.6 percent increase over the 16,933,489,000 kwhr sold in Nov, 1946. Total generation in Nov, 1947, increased only 9.5 percent over the corresponding month of 1946.

Classification of Sales, November, 1947

Kilowatthour Sales November	Million Kwhr 1947	1946	% Change
Residential or domestic.....	3,876	3,414	+13.5
Rural (Distinct rural rates)..	382	328	+16.7
Commercial or industrial			
Small Light & Power.....	3,346	2,944	+13.7
Large Light & Power.....	9,757	8,908	+ 9.5
Street & highway lighting....	234	222	+ 5.3
Other public authorities.....	502	460	+ 9.0
Railway & railroads			
Street & interurban.....	359	387	— 7.1
Electrified steam railroads..	219	222	— 1.7
Interdepartmental	51	49	+ 3.8
Total to ultimate customers	18,726	16,933	+10.6

The total for the former being 21,847,000,000 kwhr, and for the latter 19,949,084,000 kwhr, the Edison Electric Institute has reported.

Revenues from ultimate customers amounted to $335,687,200, an increase of 11.7 percent over the $300,599,300 of Nov, 1946.

For the 12 months ended Nov 30, 1947, the average use per customer was 1,426 kwhr. This was an increase of 8.1 percent over the 1,319 kwhr of the year previous. The average annual bill increased 3.4 percent from $42.74 to $44.21. Revenue per kwhr decreased 4.3 percent from 3.24 cents to 3.1 cents.

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Iowa's Move to Stop Co-op Fails on FPC Technicality

Iowa's latest protest against federal licensing of a cooperative's hydro-electric venture failed last week (Feb 5) on strictly technical grounds. In so ruling, however, the Federal Power Commission left the way open for further action by the State.

Iowa had applied for rehearing of FPC's order of last Dec 19 authorizing construction of dams and a power plant on the Cedar River by the First Iowa Hydro Electric (EW, Jan 31, Page 42). The State previously fought the co-op project through FPC hearings and in the courts.

In rejecting Iowa's appeal, the Commission pointed out that its Dec 19 order was not final and that the co-op was required thereunder to amend its engineering plans, obtain Army approval of the project, and complete the development. If these conditions are met and a final order authorizing a license is issued, FPC ruled, it will then consider applications for rehearing. But, under the Commission's rules of practice and procedure, such an application is "premature" until the final order is issued.

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Montana Power Granted Permit for 2nd Kerr Unit

Montana Power Co's plans to install a second 56,000-kw generating unit in its Kerr hydroelectric plant were approved last week by the Federal Power Commission. The company expects to complete the addition by January, 1949.

In its application for amendment of the federal license for the Kerr Plant, the company reported that it would soon need the additional capacity to meet load growth and to provide more flexible operation of the plant. The new unit will increase average annual output by 353,000,000 kwhr and critical year output by 217,000,000 kwhr, it was estimated. The plant is located on Flathead Lake and River at Polson, Mont.

Ebasco Strikers Get OK to Picket Subcontractor

If the Project Engineering Co does work for Ebasco Services, Inc, striking Ebasco employees may picket Project's offices without violating the secondary boycott provision of the Taft-Hartley Act.

This was the interpretation of Judge Simon H. Rifkind, United States District Court, New York City, in denying a petition of the National Labor Relations Board to enjoin the strikers from picketing.

The strike started Sept 5 when Ebasco employees, members of the Metropolitan Association of Architects, Engineers, Chemists & Technicians, were refused a pay increase. Many Ebasco workers stayed on the job. But an additional amount of work was let out on contract to Project which had Ebasco contracts before the strike.

Both firms were picketed. They claimed that this was a secondary boycott. The regional NLRB officials agreed and sought the injunction. Should NLRB agree with its New York office, it can take the case to the United States Circuit Court.

MEETINGS

American Institute of Electrical Engineers—Great Lakes District Meeting, Fort Des Moines Hotel, Des Moines, Iowa, April 1-3; North Eastern District Meeting, Taft Hotel, New Haven, Conn., April 28-30; Summer General Meeting, Palace of Fine Arts, Mexico City, Mex., June 21-25. H. H. Henline, secretary, 33 West 39th St., New York 18, N. Y.

PREVIOUSLY LISTED

Edison Electric Institute—Accident Prevention Committee, Roosevelt Hotel, Pittsburgh, February 16-17; Annual Sales Conference, Edgewater Beach Hotel, Chicago, April 6-8; Annual Convention, Hotel Traymore, Atlantic City, June 1-3.

Pennsylvania Electric Association—Prime Movers Committee, Hotel Alexander, Hagerstown, Md., February 19-20; Electrical Equipment Committee, Castleton Hotel, New Castle, Pa., February 19-20; Systems Operation Committee, Abraham Lincoln Hotel, Reading, Pa., February 19-20; Transmission and Distribution Committee, Castleton Hotel, New Castle, Pa., February 26-27.

National Adequate Wiring Bureau—Annual Conference, Stevens Hotel, Chicago, February 22-26.

American Society of Mechanical Engineers—Spring Meeting, St. Charles Hotel, New Orleans, March 1-4.

Electric League of Western Pennsylvania—Planned Lighting Exposition and Conference, William Penn Hotel, Pittsburgh, March 1-4.

National Association of Purchasing Agents—Public Utility Buyers' Group, Mid-Winter Conference, Roosevelt Hotel, New Orleans, March 8-9.

Oklahoma Utilities Association—Annual Convention, Biltmore Hotel, Oklahoma City, Okla., March 11-12.

National Electrical Manufacturers Association—Winter Convention, Edgewater Beach Hotel, Chicago, March 14-18.

Canadian Electrical Association—Western Conference, Palliser Hotel, Calgary, March 15-17.

Institute of Radio Engineers—Annual Convention, Hotel Commodore, and Radio Engineering Show, Grand Central Palace, New York, March 22-25.

American Institute of Electrical Engineers—Conference on Electron Tubes for Instrumentation and Industrial Use, sponsored by the Joint Subcommittee on Electronic Instruments, Benjamin Franklin Hotel, Philadelphia, March 29-31.

Southeastern Electric Exchange—Accounting Conference, Henry Grady Hotel, Atlanta, April 1-2; Annual Meeting, Boca Raton, Fla., April 8-10; Spring Conference, Engineering and Operating Section, Tampa Terrace Hotel, Tampa, Fla., May 6-7.

National Association of Corrosion Engineers—Annual Conference and Exhibition, Jefferson Hotel, St. Louis, April 5-8.

Midwest Power Conference—Sheraton Hotel, Chicago, April 7-9.

Northwest Electric Light & Power Association—Engineering and Operation Section, Davenport Hotel, Spokane, April 14-16; Accounting and Business Practice Section, Davenport Hotel, Spokane, April 17-18; Annual Business Meeting, Empress Hotel, Victoria, B C., May 10; Business Development Section, Empress Hotel, Victoria, B. C., May 10-12.

Electrochemical Society—Spring Congress, Deshler-Wallick Hotel, Columbus, Ohio, April 14-17.

Missouri Association of Public Utilities—Annual Convention, Hotel Jefferson, St. Louis, April 28-30.

Engineers Club of Philadelphia—Engineering Progress Show, co-sponsored by junior members and the Franklin Institute at the Institute, May 11-16.

Public Utilities Advertising Association—Annual Meeting, Hotel Cleveland, Cleveland, Ohio, May 27-28.

West Coast Utilities Set Peak and Usage Records

Both Seattle City Light and Tacoma City Light set new power consumption records on Jan 19, reporting 4,198,000 and 3,545,000 kwhr, respectively, for the 24-hour period. Peak demand for the day for Seattle was 258,000 kw, compared to a previous high of 252,000 kw in December, and for Tacoma, 198,000 kw, with a December high of 186,000 kw.

Portland General Electric Co also announced a record day in January with a peak load of 376,000 kw and a total sendout of 6,127,000 kwhr for Jan 5.

West Coast companies which announced record outputs for December included the Los Angeles Department of Water & Power, Puget Sound Power & Light Co and Seattle Light.

Los Angeles production totaled 295,116,868 kwhr, 34,568,755 more than in Dec, 1946.

Puget Sound's December output was 255,465,545 kwhr, compared with a Dec 1946 load of 228,252,483 kwhr; its 1947 total was 2,630,302,196 kwhr, a 14 percent increase over 1946. Seattle Light tallied 115,903,000 kwhr for last December compared with 106,779,000 kwhr for the same month in 1946; for 1947 it announced a total production of 158,076,000 kwhr, a 9.6 percent increase over 1946.

Washington Water Power also announced that 1947 had been its top year for sales of electrical energy, totaling 1,859,000,000 kwhr for a 30 percent gain over 1946. The company set a record for a single day on Dec 10, when it met a net demand for more than 100,000 kw.

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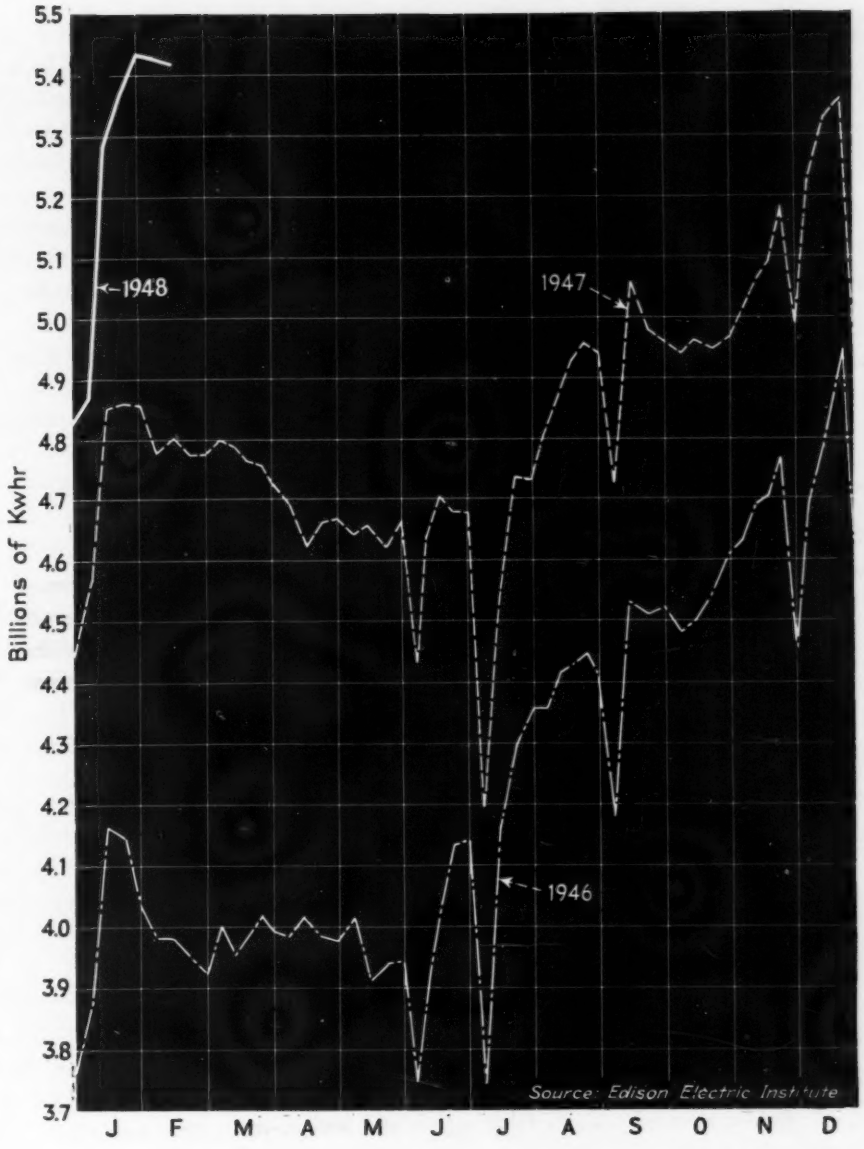
Washington Judge Held Blameless in PUD Case

There is no legal basis for charges that Judge William J. Millard of the Washington State Supreme Court had permitted himself to be improperly influenced in arriving at a judicial decision last year in the proposed Skagit PUD purchase of the Puget Sound Power & Light Co. This was the report made recently by Attorney General Smith Troy following an exhaustive investigation.

Troy said he was unable to develop the charge beyond the "hearsay" status. Charges had been made that the judge had changed his decision several times, while the power company's stock fluctuated in value. The court finally handed down a 5-4 decision declaring the proposed purchase illegal.



Output Continues Decreasing Slowly

Seasonal decline in kilowatt-hour output was recorded for the second consecutive week during the week ended Feb 7. Quite apparently, the anticipated slump in output, normal at this time of year, has arrived. The total was 5,412,361,000 kwhr, an increase of 12.7 percent over last year's total of comparable date. It was 24,069,000 kwhr under the record output of the week ended Jan 24, and down 16,841,000 kwhr from last week's total.

Heaviest increase was recorded in the Pacific Coast region, up 18 percent over a year ago.

Weekly Output, Millions Kwhr

1948		1947		1946	
Feb. 7	5,412	Feb. 8	4,801	Feb. 9	3,983
Jan. 31	5,429	Feb. 1	4,777	Feb. 2	3,983
Jan. 24	5,436	Jan. 25	4,856	Jan. 26	4,034
Jan. 17	5,370	Jan. 18	4,857	Jan. 19	4,145
Jan. 10	5,278	Jan. 11	4,853	Jan. 12	4,163
Jan. 3	4,868	Jan. 4	4,574	Jan. 5	3,865
1947		1946		1945	
Dec. 27	4,830	Dec. 28	4,442	Dec. 29	3,759
Dec. 20	5,368	Dec. 21	4,940	Dec. 22	4,239

Percent Change from Previous Year

	Feb. 7	Jan. 31	Jan. 24
New England	+11.5	+13.9	+11.7
Mid-Atlantic	+ 8.2	+12.1	+ 9.4
Central Industrial	+ 9.8	+11.1	+11.5
West Central	+14.5	+14.5	+13.1
Southern States	+16.5	+17.1	+13.6
Rocky Mountain	+15.0	+11.2	+10.3
Pacific Coast	+18.0	+15.9	+13.4
Total United States.	+12.7	+13.6	+11.9

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Electrical World
OPINION

Show ALL the Facts

THE TENNESSEE VALLEY Public Power Association wants to tell its story. Its story, as far as we can gather from a recent communique, is that there should be no change in the power supply set-up which exists today within TVA's service area. From TVPPA's point of view, this is understandable.

In a rather trenchant announcement that the municipals and co-ops which distribute TVA power are going to carry on their fight through a "Distributors Information Committee," we learn that:

1. "....a determined effort is being made by the private utilities...to pass legislation which will force TVA to increase its rates for power . . . 2. (it is being argued) that (TVA) is operating with interest exemption . . . 3. (that these arguments) are but a means to an end . . . 4. (that utilities are attempting to place) unnecessary expense and operating cost on TVA . . . 5. (that) rates charged by the utilities . . . carry an exorbitant profit to the private investor . . . 6. (that municipal and co-op systems are) no business or concern of the federal government . . . 7. (and that a) smoke screen (is being raised and 8. this committee will) show who is raising it. . ."

We can't prove it and don't mean to try, but it looks as if that fabulously effective TVA publicity department is worried about that John T. Flynn piece on TVA which was published in the December "Readers Digest." Why else should it be organizing Tennessee Valley Public Power Association Distributors' Information Committees? Heretofore, TVA's propagandists have swept all before them without resorting to such fronts and auxiliaries. Indeed, such devices they have attributed with scorn to "the utilities." For heaven's sakes, Flynn. What have you done?

As to the Committee's charges listed above:

1. What bills would boost TVA's rates?

2. TVA in fact does NOT pay interest except on outstanding bonds issued for the purchase of Tennessee properties, and pays less than the going rate on those. Read the TVA report.

3. Such arguments ARE a means to an end—that being to have TVA at least SHOW interest and taxes before it proclaims those net profits.

4. What is unnecessary about having the YARDSTICK SYSTEM at least SHOW the same costs as those systems it would measure?

5. Please send, by return mail, names of utilities paying exorbitant profits. We've got $31.18 to invest. But the profit must be exorbitant, like the taxes.

6. If TVA-served municipals and co-ops are "no business or concern of the federal government." why in the world do they let the government dictate their resale rates?

7. We agree on the "smoke screen" complaint. Please stop raising it. Smoke screens result from inefficient combustion, and there's already a coal and oil shortage, isn't there?

8. As to who's raising it—the smoke screen, that is—count us in. Count us in, at least, if repeated requests that TVA just SHOW interest and taxes constitute a smoke screen. We've been asking that repeatedly, for a long time. Consider this a reiteration. We realize it is unimportant whether the TVA operating profit goes to the Treasury in six checks or just one. But we think the statement ought to SHOW what those charges WOULD be if TVA were being measured, not doing the measuring.

And please, Committee, keep us on the mailing list. If TVA's drum beaters are so rattled as to have let this one slip out, we want to see the rest of their attempts to deny reality.

America's Atomic Secret

FOR MORE THAN a year, now, we've been reading quite carefully every public address made by a member of the Atomic Energy Commission. That's a lot of speeches. Through all of them, two things have been apparent. One is that the Atom Commissioners have been trying to make some great, simple point. The other is that they haven't been succeeding very well. At least, in speech after speech, they've continued to bang away at it without making it very clear to us. Now, however, it begins to look as if Commissioner Pike may have succeeded in a speech he gave in Texas not long ago. It closed as follows:

". . . We hear a lot about (atomic) secrets these days. Just what are the secrets of the atomic bomb? . . . Some people say there is no secret, that there is no piece of paper locked up with a formula which covers the subject. In a way, this is true . . . but there is a piece of paper that perhaps has a secret . . . We have marines guarding it. It is locked and sealed, and we don't keep it in any one place. We are moving it around the country from time to time. Maybe we are kidding ourselves in doing this. Maybe it isn't very important, but until we are sure there are better ways, it looks like a good thing to hang on to. It says:

"We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain inalienable rights, that among these are Life,

Liberty and the pursuit of Happiness.'

"This secret goes into everything that makes us a nation. It is many-sided, it is hard to define, it is trial by jury, the freedom of religion and assembly, it is free and universal education, it is free enterprise, open communication, opportunity to pursue the truth and follow where the truth leads us. Under our system, we tell our elected and appointed representatives what we want them to do and tell them unmistakably whether or not we like what they do or do not do. That is the thing the Molotov's of this world do not and never will understand and the thing I hope we never forget."

So long as AEC operates on this basis, at least one atomic-age problem won't cause much worry.

Nicely Put

OFFICIALS of the electric utility industry long have been trying to find the most appealing way possible to describe the position they feel their companies occupy in today's society. Following is one of the latest we've come across. We think it's put nicely enough to command what "pass-along" distribution ELECTRICAL WORLD can give it. It was published last month in the "Edisonian," Brockton Edison's paper. Here is what the "Edisonian" has to say.

"Brockton Edison Co is a business-managed, tax-paying, self-supporting electric light and power company. Just what does that mean to you—and to the area we serve?

"Brockton Edison Co is business-managed. Its officers are men who have risen from the ranks solely on merit and ability. It is their responsibility to see that the public is served well, that employees have both security and opportunity for advancement, and that investors receive reasonable earnings on the funds entrusted by them to Brockton Edison Co. All that requires business management.

"Brockton Edison Co is a tax-paying enterprise. It pays its full share of all local, state, and federal taxes. In 1947 Brockton Edison Co paid a total of over $750,000 in taxes. A business-managed electric company is a good citizen!

"Brockton Edison Co is a self-supporting company. It neither asks for, nor expects, any subsidy or exemption from any government agency whatsoever. It co-operates fully with lawfully constituted regulatory commissions, for such co-operation is the essence of democracy.

"Brockton Edison Co is a good neighbor! It is heart and soul for progress of this area. Whatever is good for this area is good for Brockton Edison Co. Whatever hurts Brockton Edison Co in time will hurt this area. Our futures are bound up together. We live here, work here, pay taxes here, and educate our children here. In short, Brockton Edison Co is for this area—all the way! Working together, we can make this area a still better place in which to live. That is our thought for all the New Years which lie ahead!"

WASHINGTON COMMENT

W. B. WHICHARD

No one had expected it to come up so soon, but the Congress soon must make a decision which may spell out the scope of future federal power activities. The problem involved is what to do about government water power systems when they run out of water. Water that can be put to producing more hydroelectric energy, that is.

The question has been posed now by the Tennessee Valley Authority. But almost inevitably, it must arise also in connection with most other major federal hydro systems.

It is the basic issue underlying TVA's request for funds to start a $60,000,000 steam generating plant. TVA has not yet fully exploited the hydro potential of the Tennessee river, but the end is in sight. With completion of power installations in existing plants, as now scheduled, and at the new Watauga and South Holston dams, the agency's hydro expansion program will be finished.

TVA spokesmen advance numerous arguments in behalf of the proposed steam plant. Most important of these, however, is the claim that it will enable the system to meet a "critical period" starting soon—in 1950—within the next five years when TVA's load will approach, perhaps exceed, available hydro capacity. New hydro units later will be put on the system, but what happens when and if load growth absorbs their full output and brings on a new "critical period?"

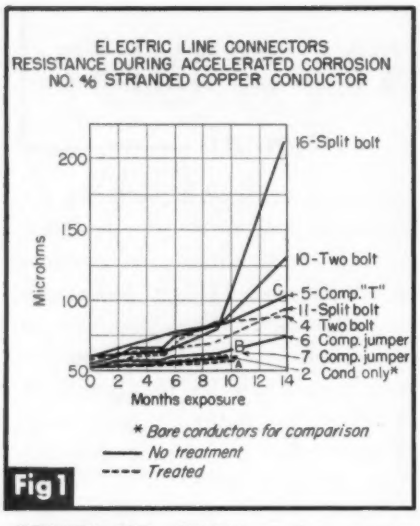
Apparently, TVA wants to build fuel-burning plants to solve any such dilemma. Only other alternative is the freezing of the agency's power functions to generation and transmission of its hydro power.

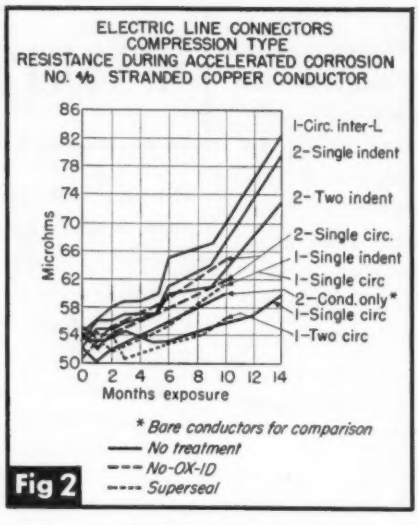
Congress traditionally has been loath to countenance federal construction of steam generating stations. True, it permitted TVA to erect the Watts Bar steam plant, but only as an emergency project, approved by the War Production Board as essential to vital military needs.

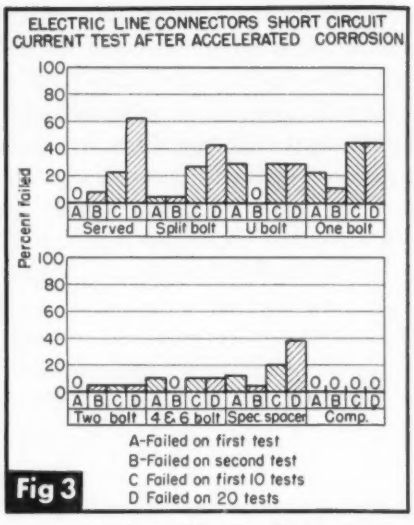
The Interior Department experienced several bitter—and losing—fights with Congress over steam plants. For example, Harold Ickes failed with repeated demands for the Antioch (Delta) plant in California.

In no instance, however, has the issue involved the quasi-utility obligation claimed by TVA on the basis that it is the sole major power supply source for an important geographic area. Unless additional capacity can be made available for the TVA region by other suppliers, the agency may well make this claim stick and develop considerable support for its steam plant proposal.

Normally, neighboring utilities, if so inclined, might shoulder responsibility for part of TVA's future load. Now they may be challenged to do so in the face of equipment shortages and other difficulties. But their acceptance of this challenge could establish the precedent for final settlement of government-industry problems wherever they arise in the TVA pattern.







RESISTANCE TREND of line connectors during accelerated corrosion (Fig 1). "A" is for compression jumper with two circumferential indents. It is also included in "B". "C" is compression "T" connection with open back . . . Resistance of compression connectors with various types of indents (Fig 2). Measurements made during accelerated corrosion . . . Effect of short circuit current on connectors (Fig 3) after accelerated corrosion shows superiority of compression type joint.

Short-Circuit Tests Predict Performance Of Corroded Connectors

R. M. SCHAHFER and W. H. KNUTZ
Northern Indiana Public Service Co
Hammond, Indiana

Accelerated corrosion tests in laboratory show that corrosive atmospheres increase joint resistance of many bolted connectors beyond safe operating values. Treatment with inhibitors slows increase in resistance but loses effectiveness with time. Compression connectors withstand corrosion best

A PREVIOUS ARTICLE* described some of the efforts we have made to find the cause of an epidemic of split-bolt connector failures on transmission and subtransmission circuits throughout our system.

These studies traced the trouble to a combination of high joint resistance and heavy short-circuit currents. They showed that to be safe under short circuit, joint resistance must be less than 100 microhms. Less than half the connectors tested met this specification. In an effort to discover the reason, the effects of workmanship (tightness), vibration, thermal cycles, and connector elongation were studied. Most bolted-type joints were unaffected by these factors. But, it was found that there was an early loss of tightness, or torque. This was traced to metal flow in the conductors. However, if corrosion did not take place, resistance of the joint remained approximately unchanged, even in the face of a loss of tightness.

This led us to suspect that corrosion lay at the bottom of the problem and set us off on the second leg of our investigations which are discussed in this article. This involved a study of the effect of corrosion on joint resistance and the ability of a corroded joint to carry short circuit current.

Most of our troubles had been experienced in highly-industrialized areas. Here loads were high, short circuit currents ran as high as 20,000 amp and the atmosphere was contaminated with corrosive fumes.

Copper exposed to such contaminated atmospheres accumulates a high resistance coating which generally takes one of the following forms: cuprous oxide, CU_2O, red; cupric oxide, CuO, black; cuprous sulfide, Cu_2S, black; cupric sulfate, $CuSO_4$, blue; and cupric carbonate, basic, $CuCO_3 \cdot Cp\ (OH)_2$.

Corrosion generally works between the copper contact surfaces, reducing and eventually eliminating contact between bright metal. A high resistance joint results.

It remained to produce this corrosion artificially in the laboratory, evaluate its effect on joint resistance and study the performance of corroded joints under short circuit currents.

* "Connector Limitations Studied," page 46 Electrical World, Jan. 31, 1948.

To produce corrosion artificially, a reasonably tight wood cabinet was built. Into it unpurified refinery gas was discharged for 413 days. Active agents in the gas were hydrogen sulfide (H_2S), hyrogen cyanide (HCN), ammonia (NH_3) and sulphur (S).

Connectors that had previously been made up into joints were placed in the chamber before the run was started. These test joints represented connections made to desired tightness and given a 60-day settling period. A complete list of the 193 joints placed in the corrosion chamber is given in Table I. Subsequently three of the compression connections on new wire, and one on weathered conductor were eliminated due to mechanical defects.

Several of the joints were treated with various compounds intended to retard corrosion. Special spacers were used on some of the split bolt and two-bolt connectors to observe their action under corrosive conditions. It was thought that lead spacers might flow around conductor strands and seal contact surfaces from corrosion. Hard metal spacers with teeth and grooves were used in the belief that these projections would penetrate the conductor and insure permanent contact.

During the 413-day run, periodic resistance measurements were made across the conductor joints. These measurements included a foot of conductor. All conductors in the test joints, except six wrapped (served) splices and one single-bolt tap were No. 4/0 hard drawn copper.

At the end of 413 days all connectors except the four found to be defective were subjected to a short circuit current for about 1/6 second. Unless eliminated by burning, eleven such tests ranging from about 9,000 to 13,000 amp were applied, followed by nine ranging from about 14,000 to 18,000 amp.

Table II summarizes results of these corrosion-current tests, both on new clean conductors and on weathered unclean conductors.

Initially New Clean Conductors

Of the 137 joints on new clean conductors placed in the corrosion chamber originally, 13 were wrapped (served) joints. Four of these 13, were also soldered. The four joints that were wrapped and soldered changed little in resistance and withstood all current tests. Resistance values of the nine wrapped, unsoldered joints increased to unsafe values and all but one—or 89.0 percent, failed on short-circuit current tests.

In all, 33 split-bolt connectors were tested. They represented five different makes. Some joints were treated with compound, as Table II shows. Of the 17 treated joints, four, or 23.5 percent, failed to withstand short circuit current tests. However, resistances of the 13 joints that did not fail were steadily increasing. This pointed to the loss of compound and the probability of ultimate failure. Ten, or 62.5 percent, of the untreated joints failed on current tests. Connectors with spring lock washers retained nearly initial tightness. Resistances increased, however, and four out of nine, or 44.5 percent, failed.

U-Bolt Connectors

Seven U-bolt connectors were tested. Two of these failed to withstand short circuit current tests. This was probably due to the greater contact area compared to split-bolt connectors. Resistance values increased, however, and failure would have eventually resulted.

Resistance of the nine single-bolt connectors increased considerably during their stay in the corrosion chamber. Four failed to withstand short-circuit current tests. The two-bolt connectors, fared better. Only one out of 21 failed under short circuit current tests. Again, however, resistance was on the increase and failure was indicated. Seven of these 21 joints were treated with compound. As a result the rise in resistance was retarded.

Only one of the nine 4- and 6-bolt connectors failed to withstand short circuit current tests. This one showed a marked increase in resistance. Resistance of the others increased at a slower rate.

Several types of special spacers were installed on 24 joints made with split-bolt and two-bolt connectors. Six

TABLE I—Connector Types Subjected to Corrosion Test

Connector Type	Initial Conductor Condition	
	New Clean	Uncleaned Weathered
Served	13	9
Split Bolt	33	0
U Bolt	7	0
Single Bolt	9	3
2 Bolt	21	0
4 & 6 Bolt	9	4
Special Spacers	24	15
Compression	18	24
Totals	134	55

TABLE II—Connector Condition After Corrosion-Current Test

	Final Resistance		Total Number Tested	Short Circuit Current Tests 9,000 to 18,000 Amperes about 1/6 Second									
	100 M.O.* or less	Over 100 M.O.*		Failed on 1st Test		Failed on 2nd Test		Failed on 1st 10 Tests		Failed on 2nd 10 Tests		Satisfactorily Withstood 20 Tests	
				No.	%	No.	%	No.	%	No.	%	No.	%
New Clean Conductor:													
Served Splices	4	9	13	0	0	1	7.7	3	23.0	5	38.5	5	38.5
Split Bolt													
No Treatment	3	13	16	1	6.3	1	6.3	8	50.0	2	12.5	6	37.5
No-ox-id	8	3	11	0	0	0	0	0	0	2	18.2	9	81.8
Red Lead	0	3	3	0	0	0	0	0	0	1	33.3	2	66.7
Superseal	0	3	3	0	0	0	0	1	33.3	0	0	2	66.7
U Bolt	3	4	7	2	28.6	0	0	2	28.6	0	0	5	71.4
Single Bolt	2	7	9	2	22.2	1	11.1	4	44.4	0	0	5	55.6
2 Bolt													
No Treatment	7	7	14	0	0	1	7.1	1	7.1	0	0	13	92.9
No-ox-id	6	0	6	0	0	0	0	0	0	0	0	6	100.0
Red Lead	0	1	1	0	0	0	0	0	0	0	0	1	100.0
4 & 6 Bolt	8	1	9	1	11.1	0	0	1	11.1	0	0	8	88.9
Special Spacers													
No Treatment	3	15	18	3	16.7	1	5.6	4	22.3	3	16.7	11	61.0
No-ox-id	4	2	6	0	0	0	0	1	16.7	1	16.7	4	66.7
Compression	15	3	18	0	0	0	0	0	0	0	0	18	100.0
Totals & Per Cent	63	71	134	9	6.7	5	3.7	25	18.7	14	10.5	95	70.8
Weathered Conductor:													
Served Splices	0	9	9	9	100.0	0	0	9	100.0	0	0	0	0
Single Bolt	0	3	3	1	33.3	0	0	3	100.0	0	0	0	0
4 Bolt	0	4	4	4	100.0	0	0	4	100.0	0	0	0	0
Special Spacers	0	15	15	13	86.7	1	6.7	14	93.3	1	6.7	0	0
Compression	6	18	24	3	12.5	3	12.5	11	45.8	1	4.2	12	50.0
Totals & Per Cent	6	49	55	30	54.6	4	7.3	41	74.6	2	3.6	12	21.8

* Microhms.

of the joints were treated with compound. Nine of the 24 joints failed to withstand short circuit tests. Lead-spacers were tried in the belief that the lead would flow and seal out corrosion. However, two out of 10 failed and all resistances increased to unsafe values. Everdur and aluminum-bronze spacers with sharp teeth were also tried. It was hoped the teeth would make corrosion-resistant contact with conductors. Seven out of 14 of these failed.

Compression connectors were not neglected. Three T-connectors fell apart during corrosion due to disintegration of brazing. None of the remaining 18 joints failed under short circuit current tests. Thirteen of the compression joints were straight end-to-end splices. Resistance values increased but little. The remaining five were T-connectors with open backs for installation on conductors under tension. Resistance values of these five joints increased to the danger zone.

Weathered Conductors

Resistance of all nine of the wrapped splices made with weathered conductors rose to high values. All nine joints failed on the first short circuit current test. Similar experience was had with the three single-bolt, four 4-bolt and 15 connectors with special spacers. In all cases resistances were high and all joints failed, mostly on the first short circuit test.

Of the 25 compression connectors tested on weathered conductors, one T-connector again fell apart during corrosion. Of the 24 remaining connectors 12 failed to pass the short circuit current tests. Four of 15 end-to-end joints failed and eight of nine open-back T-connectors also failed. Only half of the compression connectors installed on weathered conductors failed, but all other connector types failed.

Resistance Trends

Resistance trends of the principal types of connectors are shown graphically in Fig 1. Note that the rise in resistance of split-bolt connectors is much more rapid than in other types; that treatment of joints with compound retards resistance rise but that there is an apparent loss of compound. We may expect that eventually resistance of such treated joints will go to dangerous values.

In all but one type of compression connector there is only a nominal rise in resistance. This type, a "T", is for taps, and is made with an open back so it can be installed on a conductor under tension without cutting the conductor. The back is closed with a compression tool. Apparently this closing doesn't make a perfect seal and corrosion is more pronounced than in other types of compression connectors.

Resistance trends of compression connectors is given in more detail in Fig 2. The open back T-connector has been omitted. Indent and interlocking circumferential compression joints have a comparatively fast rise in resistance. Plain circumferential compression joints show very promising results, particularly when two compressions are made. This is due, without doubt, to a better seal against corrosive atmospheres. The seal retains treating compound longer and gives it better staying properties.

Figures 1 and 2 show that the rate of rise of resistance is low for the first nine months. This is followed by a marked increase in the rate. Apparently it takes a certain interval for corrosion to work in between contact surfaces. The trend of the graphs is exactly what was expected, but the time to reach the higher values was longer than expected.

Results obtained from short circuit current tests on initially clean conductors is shown graphically in Fig 3. Note that no compression connector failed though they all received 20 short circuit current tests. Note also that compression joints were the only ones that withstood the complete cycle of tests successfully. Two-bolt connectors were low in failures; only about 5 percent failed. About 43 percent of all split-bolt connectors failed; consisting of about 62 percent of those with no treatment; 18 percent of those with No-ox-id; 33 percent of those with red lead; and 33 percent with superseal treatment.

Conclusions In Brief

1—Corrosive atmospheres increase joint resistance in many bolted connectors.

2—Red lead or No-ox-id on conductors in split-bolt connectors retard corrosion slightly. Some treated connectors on new clean wire failed on corrosion-current tests, however. Resistance increased steadily, apparently showing that such treatment loses effectiveness in time.

3—Compression connectors: (a) Compression tools provide proof of adequate workmanship. (b) Compression connectors have a self-cleaning action when installed on corroded wire. Sometimes this action gives low-enough resistance to withstand high short circuit currents. But it is not sufficiently uniform to warrant eliminating cleaning. (c) Compression connectors maintain lower resistance than all other connectors in corrosion test. (d) They are satisfactory for connection that can be made with a straight sleeve.

4—No compression connector installed on a clean wire failed under short circuit test.

5—All connectors but compression types failed on corrosion current tests when installed on uncleaned weathered wire. Only half the compression connectors failed this test.

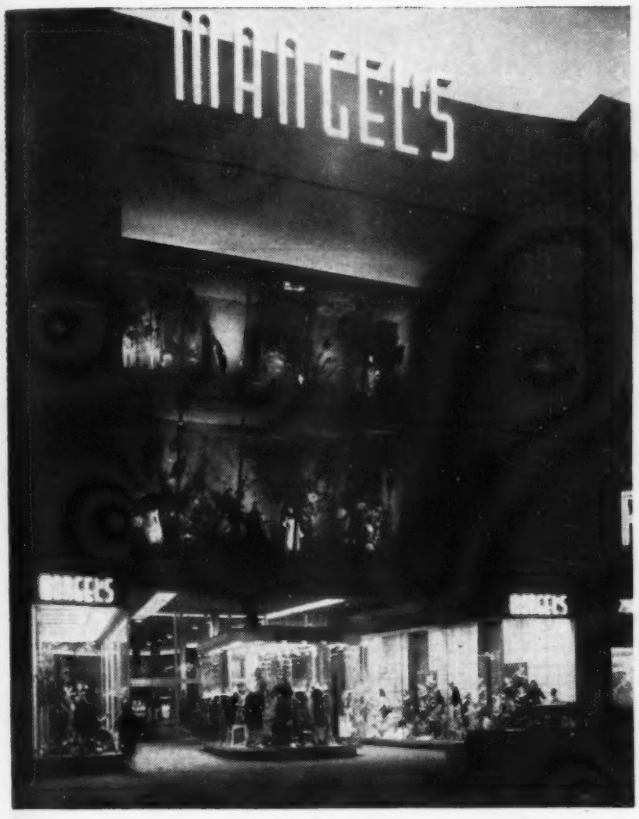
6—Split-bolt connectors on the market are unsuitable for use in highly corrosive atmosphere when subject to heavy short circuits. Part of the trouble may be corrosive action on the conductor at the point of contact. Methods of combatting this must be positive, permanent and inexpensive.

7—Regardless of connector type the tool used in installing it must insure good workmanship.

8—Cost of energy losses justifies a lower-resistance connection than is obtained with split-bolt connectors in corrosive atmospheres.

9—Energy loss in split-bolt connections may be higher than we think in non-corrosive areas.

10—Though end-to-end splice-type compression connectors are satisfactory, more study is needed to produce a satisfactory T-type connector.



EYE TRAVEL from inclined show windows overhead leads into the attractively lighted store entrance below

LIGHTING SHOW CASES with 150 ft-c makes them stand out against the 30 ft-c of general illumination

COVE LIGHTING is extensively used on walls and in recessed clothes racks throughout the store

Lighting Store to 1-3-5-10 Formula

WITH ITS RANGE from 30 ft-c for general illumination to 350 for free-standing displays and in windows, the new Mangel's store in Birmingham, Ala, generously fills the 1-3-5-10 prescription for modern store lighting. The store was designed and built by Ross Frankel, Inc, who cooperated closely with illuminating engineers of the Birmingham Electric Co.

Illumination is provided by 300-w down-lights with lenses flush in the ceiling. This is supplemented by cold-cathode fluorescent in recessed and open coves and by use of R-40 reflector flood and spot lamps.

The store front is a spectacular combination of architecture and lighting. The second and third floor windows, softly outlined above by coved fluorescent, incline inward to the brilliantly lighted entrance from which lines of flush troffers extend well into the store. The upper floor windows are illuminated entirely by 300-w floods and spots, "idea" lighting, so called. The side and center island street level windows are equipped with mirrow glass 200-w reflectors on 12-in. centers, supplemented by louvered fluorescent troffers and by R-40 spots and floods. A novelty inside the store is the use of pendant floods over wrapping counters. Total connected lighting load amounts to 64.8 kw.

FOUR-UNIT closed troffer over show case adds 45 ft-c to lighting of merchandise inside the case

LIGHT is employed as an architectural element by means of ceiling and wall cutouts

don't call it public relations:

W.W.P.Co Seeks "Better Service" Through Service

KIMBALL JACK
Advertising and Publicity Manager
Washington Water Power Co.
Spokane, Wash.

AROUND THE WASHINGTON Water Power Co, in Spokane, the term "public relations" is a nasty word—or close to it. But despite the company's aversion to the term and the commoner aspects of the practice, the need for some type of program—aimed both at employees and customers—was apparent. So management decided to do something.

Our ideas on what others often call public relations rest on one point—doing many practical things simultaneously. With us, such an effort—tied to the day-to-day operating job—seems to achieve at least one thing. That is a closer relation between W. W. P. Co employees and at least a percentage of our customers.

After a good deal of thought, Water Power came up with a "Better Service Program." It started with a pretty detailed public opinion survey. But in this one, the company didn't confine itself merely to orthodox public utility questions. It sought information on deeper subjects, as well. What were customers thinking? What did they want in life? What did their communities need? The questionnaire not only developed what the cash customers think of Washington Water Power but a lot of ideas as to how it could help improve things generally. It yielded the data for half a dozen programs.

A similarly frank questionnaire was addressed to the employees. What did they like about WWP—and their jobs? What didn't they like? Answers were unsigned. Let him complain who wants to. He did.

The data in, it was compiled and the showing given to all employees. This took place in meetings of 50 to 80 employees. Then came the stinger.

"Would employees like to work, actively, to correct the deficiencies the survey brought to light? If so, about one year's trial ought to be given the idea."

Employees Loved It

The employees, it developed, would like to do just that. So a dozen committees were organized, each to handle a different project. Employees were invited to choose those on which they wanted to work. Eighty-eight percent of the staff joined. Three projects were most popular, judging from enrollment for them. They were:

1. Passing along company information to the rank and file.
2. Mailing special items on policy to customers.
3. Making informal visits to new customers.

It was agreed that all work would be done outside working hours. By way of introducing a competitive element, the suburban areas were pitted against the Spokane organization. There were rewards beyond the usual recognition. A divisional party when the program ended was one. A dozen "expense-paid" trips "back East" for outstanding employees was another. The competition was brisk.

One project, which was outstandingly successful, was the mailing of Christmas cards to each of the company's 100,000 customers. Mailing committees seized this task promptly, asking to hand-address each card. Their members carried armfuls of blank cards home at night, brought them back next day ready to mail. The job went off without a hitch.

Newcomer committee members made calls of welcome on each new customer. To help them, a new-

What Do You Think About . . .

The Public Thinks W. W. P. Co Is...

Employees Pitched In And . . .

comer's booklet was prepared. Courtesy committees visited 504 employees during the contest's first month, distributing literature on how to meet the public graciously under varied circumstances — telephoning, meter reading, tree trimming, etc. Speakers committees trained employees in public speaking. In the first month, 23 employees delivered 50 talks before community organizations. Window committees told the company story elsewhere — and developed exhibits for outside groups in company windows—44 of them.

Meetings Maintain Interest

To improve supervisory effectiveness—and to make a good company even better—steps were taken to conduct a supervisors training course. This was made effective by enlisting industrial relations staff members from a local college. These classes used material which arose from field situations. Dramatized narrative and free discussion also helped this program.

Three types of meetings were held regularly to keep the program going. In one series, executive officers met monthly. They initiated and discussed programs. They got the business picture from top management.

In a second series, employees from each service area were drawn by lot to visit Spokane for a talk with the president or vice president. They were unaccompanied by any supervisor.

The third series—and the main one—was a group of monthly meetings, either for dinner or on company time, which covered all company employees. At these meetings, business and pleasure was mixed. The program would be reviewed and some general topic would be discussed. The topic-of-the-month would be chosen by survey. It might be courtesy, new industries, rate or collection policies. It might be electric house heating. It was promoted before the meeting through various employee contacts.

What has the "Better Service Program" achieved? It certainly hasn't induced management to sound off in praise of it in any exaggerated fashion. It is plain that there are so many possibilities to the program that employee enthusiasm may die before they are done. Customer reaction may swing, undoing everything. Public ownership propaganda may defeat the whole program.

There is no attempt to say that a majority of our employes gave enthusiastic support to the program. Usually, a few workers carry the heavy load. The chronic complainers will always emerge, in any company.

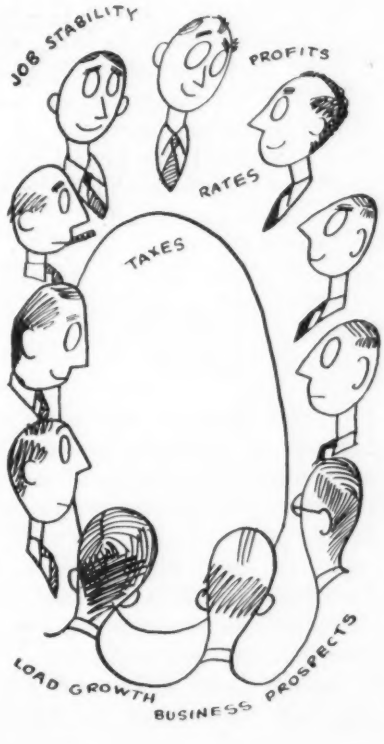
Then too, such a program will encounter at least a little friction at the top operating levels. Many of these men feel that their day-to-day job of electricity supply, handicapped as it is today, leaves them no time for intangibles. In such cases, only top management, the true public relations department of any company, can coordinate all parties into a smoothly-working whole.

Hardest Problems Remain

Another problem is following up on the information sought by the questionnaire. For example, how can the manager of a small-town company office aid customers who told the survey that the community badly needs more education, crime prevention, or new industries? What does he do for those whose deepest wish is an assured income, or to do important things in life?

But thus far, the company finds a "plus" in the program. Employees have a goal to work for—and are happier for it. Many are developing unexpected traits of leadership. All who try are making new friends. Such results will always be worth the effort.

Top Management Keeps Employees Informed On . . .



Our Managers Have Problems, But . . .

Electric Power And Our National Defense

WALKER L. CISLER
Executive Vice-President
The Detroit Edison Co
Detroit, Mich.

The author wishes it understood that this article represents his own personal views and experience and does not necessarily reflect the thinking of others who may be equally, or more, informed on the subject*

ELECTRIC POWER in its relation to our national defense is a subject of great concern, a matter of solemn responsibility, to everyone in the electric utility industry. It is, or should be, a subject of deep concern to all Americans since its reaches into almost every home, business establishment, and industrial enterprise. The history of the two great world wars has proven dramatically the vital part of electric power: Literally speaking, those who won had enough; those who lost, not enough. It will be equally true in any future conflict in which we may be forced to engage.

Electric power is important to our peacetime economy because a healthy peacetime economy is essential to maintaining a strong national defense position. Our United States electric power industry is today engaged in the greatest expansion program of its history in order to make up for what could not be added during the war and to meet postwar load increases.

In planning our peacetime expansion program, we must not lose sight of what our needs may be in preparing for a future conflict using equipment and weapons of far-reaching significance. This is an aspect of our expansion in the consideration of which we should be influenced by the advice of those who are directly responsible for the military advances of the country. With such a vast program under way, it would be unfortunate, and might later prove disastrous, if the thinking of our national defense authorities was not fully reflected in the planning and expansion of the electric power industry. Serious and constructive steps have already been taken to bring about closer cooperation between our industry, both manufacturing and operating, and the government agencies concerned, for the common purpose of preparing our defenses. It is to be hoped that measures to bring about a fuller working relationship will be stimulated to a still greater degree. In this respect, the Department of National Defense is the logical government agency which should be concerned with the subject.

Specifically, there should be appointed by and made answerable to that Department an Electric Power Industry Advisory Group with the following responsibilities.

1. To keep currently informed on electric power load and capabilities throughout the country, preferably on an area basis.

2. To keep currently informed on anticipated loads and additions to capacity for 5 years ahead.

3. To keep informed as to possible new loads which are known only to the Armed Forces.

4. To consider matters of planning from a national security standpoint such as types and sizes of generating stations, transmission and switching facilities, and amount of reserve capacity needed for reasonable reliability.

5. To keep informed on manufacturing capacity for main generating, transformation, and switching equipment.

6. To keep informed on the electric power situation outside of the United States in those countries which might be allied with or opposed to us in the event of future hostilities.

Membership on such an Industry Advisory Group should include representation from the Armed Forces, the federal and state regulatory agencies, the equipment manufacturing industry, and the operating industry, both public and private. The personnel named should be from the top engineering executive levels of both government and industry so the adoption of policies can be effectively carried out within their respective organizations and the industry in general. Such a group, composed of individuals of independent thinking and action and working together for a com-

* From paper presented at the Conference on General System Engineering, Friday, January 30, 1948 at the Winter General Meeting of the AIEE, Pittsburgh, Pennsylvania, Jan. 26-30, 1948

mon purpose of national defense, could accomplish much which might otherwise have no direction or guidance.

Practical requirements for reserve capability of large interconnected systems should be about 15 percent of load demands in order to take care of proper operating reserves and maintenance schedules. Isolated systems should have a higher figure. This percentage of reserve should be of sufficient amount to meet all peacetime requirements and in addition should provide a margin of reserve required to meet defense requirements. The amount of the defense part of the reserve margin will depend upon needs and must be discussed with military people conversant with the subject. In contrast to the thinking of some, it is believed that this "defense reserve", so to speak, whether in generating, transformation, switching, or transmission facilities should be built right into the systems and form an integral part of them. It should be recognized that this is purposely done with the full knowledge and concurrence of all interested parties—the consumers, the municipal and state regulatory authorities, and the federal agencies involved. The economic considerations require careful study and examination. Wartime experience in areas overseas has proven this to be the correct approach to the problem rather than a superimposing of some scheme of standby facilities owned by government and located around the country. This, however, does not preclude such standby facilities as the Armed Forces require such as the Floating Power Plants. In war-torn areas abroad, the restoration of electric power service other than on a bare minimum basis had to be accomplished by restoring the existing integrated facilities which normally were a part of the system. This is the practical way to do it.

From a national defense standpoint, there should be additional ties between some systems already interconnected and ties between others not yet interconnected. Such interconnections generally could not be justified during peacetime because of the cost involved—the operating economies would not be sufficient to take care of the fixed and operating expenses. However, these are interconnections which ought to be made in peacetime and not be done, as was necessary during the last war, at a time when materials and manpower were vitally needed for other direct war production requirements. It is neither fair to nor in the best interests of our national economy that such interconnections, if made, be held open during peacetime because of provisions of law which now discourage such ties. It is to be hoped that the Congress will modify the law so as to encourage such national defense interconnections during peacetime between utility systems without incurring dual regulation by both Federal and State Regulatory bodies in matters which are local in character and properly subject to local regulations.

Nuclear Energy

The sources of energy for electric power generation will undoubtedly, for a long time to come, be from those with which we are most familiar, namely, heat or thermal energy derived from the burning of gaseous, liquid, or solid fuels, and from the hydraulic energy of falling water. We should not now delay our planning for new construction in anticipation of the early development or influence of nuclear energy. Consequently, our planning and construction should go forward along conventional and presently known means of power generation.

It is the belief of the author that wherever possible generating sources should be decentralized within reasonable limits and large concentrations of generation should be avoided. This is not always possible and good judgment and economic considerations must prevail in taking a "calculated risk" in such instances. Underground power plants are not the answer because even they can be damaged from bomb effects, and generally are impractical. This type of plant was tried in Germany and the contribution to continuity of power supply was small, if any. Sources of power generation should not be located close to other industrial plants, if it can be avoided, because wartime experience has proven that power facilities, even though not objects of attack, may be heavily damaged because of the wider area affected than just the target itself. A striking example of this was the extensive damage to the Goldenberg Power Plant, the largest in Germany, resulting from an air attack on a nearby chemical plant.

In order that the full electric power resources of the country shall be utilized, if there be need to mobilize industry as was done during the last war, there should be a continuing plan of bringing together qualified personnel from both the industry itself and from the agencies of government concerned. Only by such means can we have available the type and kind of people and experience that can work together harmoniously and effectively in the national interest. Such an organization and staff existed during the last war and could well serve as a model for future action. It was far superior to that which existed in Germany for the same purpose.

In conclusion, let us summarize these thoughts and try to present ways and means of bringing about constructive results which will help to maintain our nation's industrial capacity in time of war.

1. An adequate supply of electric power is essential to both a healthy peacetime economy and to the preparation of and carrying out of a national defense program.

2. During peacetime, there should be drawn an effective, coordinated plan which would provide guidance in the expansion of the electric power industry in relation to national defense.

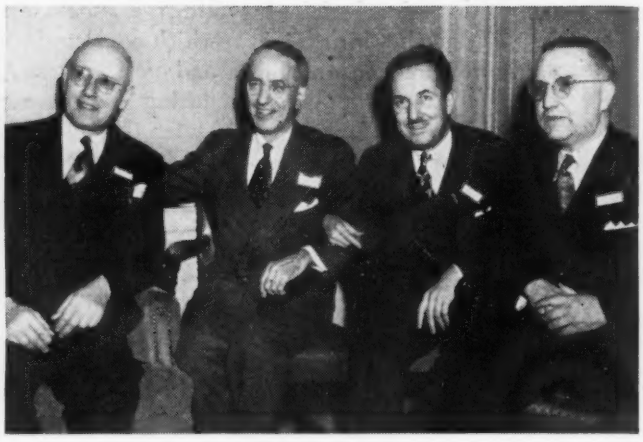
3. The experience of the last war should be heavily drawn upon in planning moves to be made in case of widespread destruction resulting from future hostilities.

4. There should be formed, at an early date, an Electric Power Industry Advisory Group by the Department of National Defense to be concerned with subjects earlier outlined. This action is vitally important.

5. The participation of the electric power industry during peacetime in matters involving our national defense would certainly lead to the fulfillment of constructive military objectives. It was one of the most patriotic and cooperative industries during the last war.

6. The maintenance of a position of national industrial strength is in the author's opinion, the best assurance of the prolongation of world peace. Investment in the industrial system which is recognized as typical of this country is the most hopeful means of defending the nation's traditional way of life.

C. T. Sinclair, Duquesne Light Co, J. F. Fairman, Consolidated Edison Co of New York, J. O'R. Coleman, Stone and Webster Engineering and Herman Halperin, Commonwealth Edison Co



H. S. Fitch, West Penn Power Co, J. H. Foote, Commonwealth and Southern, T. F. Peterson, American Steel and Wire Co and E. V. Sayles, Consumers Power Co

AIEE SESSIONS STRESS

MORE THAN 3,000 electrical engineers registered at the meetings of the AIEE winter general meeting in Pittsburgh January 26-31, 1948. They were repaid by an unusually diversified and timely program. Among the more heavily attended sessions were those devoted to high voltage cables, railroad electrification, excitation and governing, switchgear and distribution continuity.

Description of cable installations in New Orleans and New York started spirited discussion of the various in-pipe schemes. Particularly deliberated were the merits of polyethylene as sheath material. The heavy traction session was so pertinent as to the superior economies of railroad electrification even for moderate traffic that it may well be the opening move for a new drive toward electrification.

Excitation and stability were issues discussed largely because the growing use of capacitors to conserve generating capacity had raised alternator power factors on metropolitan systems so high that stability was a matter of concern. Fears now appear largely unfounded. Switchgear sessions dealt with the new 230 kv breakers including those for 10,000,000-kva interruption.

A session on distribution continuity was part of the committee's program of eliciting experience and data toward evaluating the factors in improving the reliability of power distribution systems. Duquesne Light Company authors told the details of the utility's recent 10,000-kva series capacitor. This installation and the 500-kv test line at Brilliant, Ohio were among the many technical inspection trips.

HIGH-VOLTAGE CABLES

138-Kv Polyethylene Sheathed Compression Cable, Pipe-line Type. J. E. McCormack, C. T. Hatcher, *both Consol. Ed.*, K. S. Wyatt, W. A. Del Mar, E. J. Merrell and J. H. Palmer, *all Phelps-Dodge Copper Prod.*, E. F. DeTurk, *Long Island Lighting.*

Historical evolution and details of New York cable; fabrication, accessories, installation of 350,000 cir mil, 200 psi.

115-Kv High-pressure Oil-filled Pipe Cable Installation at New Orleans. W. R. Bullard, *Ebasco Services*, A. D. Pettee, *General Cable*, G. L. Rhodes, *New Orleans P.S.*

No stop joints; no permanent manholes; polyethylene tape seal supplants customary lead sheath; weather-tight reel; pulling lengths 1500 to 2500 feet.

Thermal Characteristics of 120-Kv High-pressure Gas-filled Cable Installation. W. D. Sanderson and J. Sticher, *Detroit Edison*, M. H. McGrath, *General Cable.*

Comprehensive report of tests and observations over 6-year period; temperature pattern, soil and pipe-covering resistivity, steel pipe losses.

Location of Gas Leaks in Pipe-encased Gas-pressure Cable Lines. J. D. Piper, *Detroit Edison.*

Direction, distance and magnitude of leak inferred by watching rate of feed and migration of CO_2 and N tracer mixture.

Use of Reduced-scale Models for the Solution of Cable Temperature Problems—Part II. Andrew Gemant and Joseph Sticher, *Detroit Edison.*

Mathematical and experimental substantiation of method of predicting temperatures under various load cycles.

Progress in cable technology as reflected by the papers was welcomed by Herman Halperin, Commonwealth Edison, but he wondered whether it necessitated launching as many as ten different cable-in-pipe systems. He queried about the vulnerability of polyethylene to temperature and added that oil-filled cables appeared to involve no more maintenance than the pipe types.

Much of the other discussion centered on "who created what first" and whether the polyethylene sheath of the New York cable would or would not stimulate or prevent voids.

A thorough analysis of this factor was presented by G. B. Shanklin, GE. A. D. Pettee, General Cable, inferred that an obvious effort had been made to emphasize the merits of polyethylene in averting the precautions commonly followed for other types but that, however, most of these same precautions were taken in the installation reported. He questioned the justification for the complications involved and sensed a growing tendency to dispense with sheaths entirely, wondering whether

F. M. Clark, General Electric Co, R. J. Wiseman, Okonite Wire and Cable Co, M. S. Oldacre, Commonwealth Edison Co, A. D. Pettee, General Cable Co and M. W. Ghen, Duquesne Light Co

Alexander J. Krupy, Commonwealth Edison Co, K. B. McEachron, General Electric Co and E. B. Robertson, Elgin B. Robertson Co

IMPROVED SYSTEM TECHNIQUES

the polyethylene sheath was not therefore, atavistic.

"Naturally glad" to see the pronounced interest in pipe-type cables was R. J. Wiseman of Okonite. He concurred that the trend is toward elimination of sheaths and added that high voltage pipe-cable installations are usually cheaper than duct jobs. R. W. Atkinson, General Cable, contended that the cable under discussion must accommodate its changes in volume with load cycles in some other way than the elliptical adjustment cited in the paper. This raised in his mind some doubts about the uniformity and completeness of saturation of insulation.

In rejoinder to all this adverse comment from his cable-making compatriots, K. S. Wyatt, Phelps-Dodge, admitted adopting and improving the skid-wire principle and asserting he was confident of the ability of polyethylene to withstand 90 C. He pointed to the 115 miles and 33 installation of 200 psi gas cables in pipe—all working satisfactorily—and asked "who else but the older oil-filled group could cite any such scope and results."

Cleaning of the pipe by resort to vacuum was stated by Hatcher to be unnecessary, the so-called mouse procedure being adequate. In connection with the New Orleans installation, Shanklin doubted whether elimination of the relatively small cost of semi-stop joints was justified since the joints sectionalize the cable run against wholesale contamination.

The thermal conductance approach to cable heating rather than the thermal resistance method was preferred by J. H. Neher, Philadelphia Electric because radiation is also involved. Radiation is negligible in the case of oil whereas conduction is practically negligible in the case of gas, he said, proposing a method for evaluating soil resistivity. Wiseman said the Detroit data confirmed the Okonite stand in discounting the high values of soil thermal resistivity assumed by British cable engineers. New York data was said by Hatcher to afford comparable confirmation.

RAILROAD ELECTRIFICATION

Comparative Operating Results of Steam, Diesel-electric and Electric Motive Power. J. F. N. Gaynor, *Great Northern R.R.*

M-g type locomotive found superior. Cheaper power and no restrictive demand rates are requisite to extension of electrification. No electric power failures in 20 years. Pleas for standardization of locomotives.

Power Costs and The Contribution of Existing Transmission Networks Towards Cost Reduction of Power for Electrification of Main Line Railroads with Moderate Traffic. Llewellyn Evans, *TVA*

Three-utility supply to 330-mile line shows a-c cheaper than d-c and that there is economic justification for electrification of roads other than those with heavy grades and heavy traffic.

Railroad Electrification Energy Conversion and Transmission Costs. R. L. Kimball and J. G. Holm, *both Gibbs & Hill, Inc.*

24-kv a-c and 6-kv d-c comparable economically for 330-mile moderate traffic road but a-c has slight edge as to both capital and annual costs.

Are the Overhead Distribution Costs Retarding Railroad Electrification? L. W. Birch *Ohio Brass.*

Answered negatively. Standardization, off-track equipment, use of ground crews for pole-setting, higher contact voltage, simplified alinements among items advanced for lower costs.

Undercurrent at this session indicated that electrification of railroads with moderate traffic can be rendered economically feasible. It was evident that experience with competitive forms of motive power is increasingly favorable to electrification. Some of the deterrents are the traditional methods of operation with steam locomotives and with all erection and maintenance done by work trains that are suitably equipped for operations of this type.

A further handicap brought out in discussions contributed by Sidney Withington and H. F. Brown of New Haven R. R. was the power company's attitude that the railroads should provide their own conversion facilities. Advantageous utilization of electric consumption and demand by optimum scheduling of trains is, on the other hand, something which

President B. D. Hull of AIEE with Dr Joseph Slepian, Edison Medalist and Jack T. Wilson, Allis-Chalmers Mfg Co

J. R. North, Commonwealth and Southern Corp, A. C. Monteith, Westinghouse and J. E. Hobson, Armour Research Foundation

is hardly to be expected of train despatchers. Brown's assertion was that the conversion costs, rather than the contact wire outlay, are the reasons for the prevailing favoring of diesel-electrics. There was the intimation that the scarcity of fuel which in other countries had prompted electrification would do likewise here as depletion of oil made the diesel locomotive less attractive.

Withington's comment on Birch's suggestion that off-track equipment for construction and maintenance of catenary and structures should greatly reduce costs was that restricted right-of-way and cuts-and-fills in congested areas made inescapable the more costly operations by work-train. Diesel-electrics cost about 80% more than electric locomotives. For a 100,000-mile service per year each electric locomotive saves $25,000 which can be applied to overhead electrification. Their final comment was that the electric locomotive will command new attention from railroad management as soon as the roads can finance directly rather than through equipment trusts.

The fleeting of freight trains assumed in the first two papers was criticized by T. M. C. Martin of Bonneville Power Administration because he said it leads to poor utilization of locomotives and a load factor of only about 22%. Assumption of less concentrated fleeting would thus make the electrification more attractive to both railroad and power company because outlays by both would be less.

DISTRIBUTION CONTINUITY

This conference-session was a continuing contribution by the joint AIEE-EEI group on coordination of construction and protection of distribution circuits with the objective of improving reliability of their performance.

Application of the "abc-ABC" criterion for decision whether to fuse a branch circuit was detailed by R. F. Quinn of GE. If the customer-minute-outage *abc* for the branch totals less than the *ABC* for the rest of the feeder then it is usually advisable to fuse the branch and conversely.

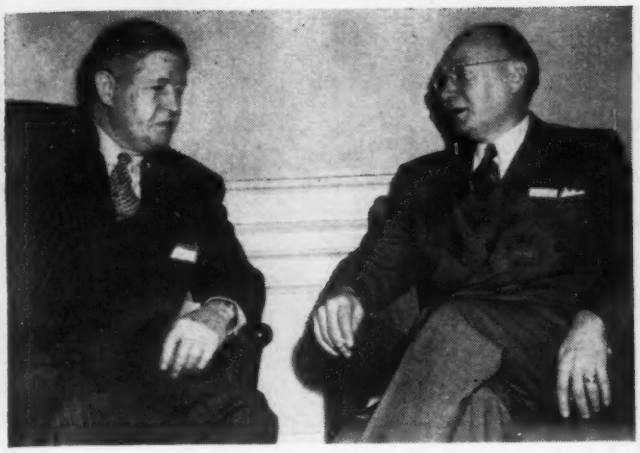
Excellent recloser results have been obtained on the rural lines of Northern Indiana Public Service said R. M. Schahfer and his paper gave comprehensive supporting data for a 9-year period. There are 115 three-shot repeater fuses and 100 single-shot installations on 369 miles of line, mostly 12.5 kv. There have been 2314 fuse blowings in 944 cases of trouble, lightning and tree limbs accounting for over 60%. Service was restored in three-fourths of the troubles due to lightning; three-shot raised the 54% performance of two-shot to 76%. Restoration was 18% in the case of tree-limb trouble for three-shot (12 percent for 2-shot).

Schahfer's conclusions, in part, were that cost of 3-shot repeaters is warranted because of better service and reduction of expensive patrols and inspections. Sectionalization restricts the faulted area except when ice trouble is extensive.

Baltimore experience reported by C. L. Headley had indicated that only a small percentage increase in restorations could be realized by using a reclosing relay providing more than one reclosure. However, there has been the belief that temporary faults sometimes persist if not cleared quickly enough by fuses. The later move has been to trip and reclose the feeder breaker before the fuse could operate; a second tripout indicates a persistent fault.

Oklahoma Gas & Electric has had such good results over 11 years from a quick-trip, slow-trip scheme that the program is being quadrupled. The breaker, said Bryce Brady, opens so fast that no fuse blows and then recloses. On a persistent fault the branch fuse blows before the time-delay relays can open the feeder breaker. In 1946-7 there were 13 persistent and 304 temporary faults on a 114-mile branched feeder (12.5 kv). The fuses cleared the 13 persistent faults and all but 2 of the transient faults.

The time-delay mentioned by Brady was detailed by his associate A. W. Walton in terms of the electronic device which renders the instantaneous relays inoperative after they have tripped the breaker and averts damage to fuses. If the fault persists the fuse blows and the breaker recloses in some 10 seconds. Where resumption currents cause difficulty the re-set portion of the electronic-time-control relay is brought out for external supervision. A procedure has been established for restoration after an outage of 30



F. D. Wyatt, Chicago Park District and L. F. Hickernell, Anaconda Wire and Cable Co

C. F. Terrell, Puget Sound Power and Light Co and Tom Fort, Westinghouse Electric Corp

minutes or more has taken place here.

J. A. Linders said Cleveland observations indicated that the starting inrush current problem was accentuating and that it appears to vary little more than 10% around the clock regardless of load. Wire burndown time in seconds for No. 6 wire seems to be 125 divided by amperes and for No. 1/0 is 1,000 divided by amperes in the arc.

Burndown in Detroit has been reduced, said A. L. Malmstrom, by use of wire with improved covering capable of temporarily withstanding line voltage. On a 100-mile basis the burndowns were 3.1 (on 2,000 miles of improved covering) and 7.4 (on 16,300 miles of conventional weatherproof). The proportion is 40% in terms of instances and 33% in terms of conductors dropped.

EXCITATION AND SPEED GOVERNING

Generator Stability at Low Excitation, by E. L. Michelson and L. G. Lischer, *Commonwealth Edison Co.*

Unswitched capacitors can be added to the 4-kv distribution system at least until generator power factor reaches unity without danger to system stability in event of loss of one machine.

Underexcited Operation of Turbine-Generators. C. G. Adams and J. B. McClure, *GE.*

Stability limit lies farther into range of leading power factor than usually supposed. Regulator control of voltage permits operation closer to steady state stability limit.

Rototrol Excitation Systems. J. E. Barkle and C. E. Valentine. *Westinghouse.*

Auxiliary control which eliminates shaft-end pilot exciter can be applied to standard shunt exciter, built into exciter frame, run from ac motor or accompany electronic voltage regulator.

Main Exciter Rototrol Excitation for Turbine Generators. C. Lynn and C. E. Valentine, *Westinghouse.*

First 200-kw 3600-rpm main exciter for 60,000-kw turbine-generator combines function of exciter and pilot exciter in one machine under automatic or manual control.

Precise Turbine Governor. Henry E. Warren, *Lombard Governor Corp.*

New governing mechanism replaces dashpot with selsyn motor, eliminates load-changing motor and offers speed control related to time standard.

Hydraulic Turbine Governor Specification. E. B. Strowger, *Buffalo Niagara Electric Corp* and C. L. Avery, *Woodward Governor.*

Detailed explanation of provisions of recommended specification for turbine governors including definitions and statement of data to be furnished by purchaser for governor designer.

Recommended Specification for Speed-Governing of Hydraulic Turbines Intended to Drive Electric Generators. Recommended Specification for Speed-Governing of Steam Turbines Intended to Drive Electric Generators. Rated 500 kw and Up. Joint AIEE-ASME Committee on a Recommended Specification for Prime Mover Governing.

Minimum standards for speed governors applied to both steam and hydro units intended for inclusion in purchase specifications, but not aimed at precluding additional functional requirements where desired.

Method of calculation used by Michelson and Lischer gives quite conservative results, commented J. B. Ward of Purdue. Only an extremely high load through a close-by transmission line can result in operation approaching the stability limit. W. H. Osterle, West Penn Power Co, asked for further discussion of reasons for using unswitched capacitors. He uses switched capacitors at attended substations. T. W. Schroeder, United Light and Railway Service Co, added that the problem of picking up load on underexcited machines is not difficult as long as the operator is careful to add excitation to other lightly loaded machines. Automatic control of voltage is highly desirable for such operation, however.

Commenting on the proposed hydro governor specifications, T. W. Brown, of Lombard Governor Co noted that some of the provisions lean toward design features rather than governing functions. This is not true of the corresponding specification for steam-turbine governors. Hydro governors are restricted to flyball type, whereas the liquid tachometer has been found satisfactory as well as other types. The specifications, he emphasized, should not freeze designs. However, the specifications should make clear that governors should be so arranged as to make impossible simultaneous disconnection of the gates from both automatic and hand control.

Since most systems never hold frequency to some exact value, C. L. Avery of Woodward Governor Co visualized problems in utilizing the Lombard time-control of frequency. All machines of interconnected systems will have to be geared to a time system, if any one is.

TROLLEY COACH

Trolley Coach Distribution System. G. R. McDonald, *GE.*

Data compiled from experience on load fluctuations and diversity for design of distribution systems and breaker settings.

Electrically Propelled Vehicles Most Economical in City Transit. G. M. Woods, *Westinghouse.*

Officers of the Institute: H. H. Henline, Secretary, AIEE and B. D. Hull, President, AIEE

E. S. Lee, General Electric Co with J. F. Fairman, Consolidated Edison Co of New York

Comparison of investment and operating costs, and net income for street car, trolley coach and gasoline bus for several specific traffic densities.

Present distribution systems tend to employ too little copper, according to L. W. Birch, Ohio Brass Co, and designs suggested by McDonald for adequate protection usually produce systems with enough copper at good economic balance. Also, present operation of some 1300 trolley coaches, dating from 1930, indicates that the 15-yr life assumed by Woods is conservative and upward revision of this figure would increase the advantages shown for trolley coach over bus. Discussion of operating costs developed the probability of much greater proportional increase in price of liquid fuels than electric power, indicating progressively greater advantage for trolley coach as years go by.

RELAYS

Bibliography of Relay Literature 1944 - 1946. *Committee Report*

Relaying Difficulties Disclosed by Staged-Fault Tests. W. A. Morgan and Bryon Evans, *Bureau of Reclamation.*

Fault tests with new directional-distance carrier relaying and reclosing breakers on 161-kv lines detect improper operation of carrier ground relay elements, incorrect current transformer connections and defects in carrier relay circuit.

Service Restoration with Automatic Air-Break Switches. K. N. Reardon, *West Penn.*

Applications of automatic air-break switches to by-pass, grounding, isolating, transfer and sectionalizing functions on 25 kv detailed. For transfer and sectionalizing, particularly, devices prove to be effective and economical service as restoration means.

Discussers of the Morgan-Evans paper questioned shortness of reclosing intervals. H. A. P. Langstaff, West Penn, doubted the adequacy of 12-cycle reclosure. He found 20 cycles needed to dissipate arc gases. H. W. Haberl, Quebec Hydro, said "at least 19 cycles" reclosing time was necessary for conventional speed breakers. H. R. Vaughn, Westinghouse, emphasized the importance of long-time type relay characteristics in high-speed reclosure. There is occasional need for relaying for out-of-step conditions, he pointed out. C. E. Parks, Public Service of Indiana, pointed out the difficulty of closing three breaker poles simultaneously and the effect this has on relaying. He, too, had trouble with chattering directional ground relay contacts and like the authors, found a solution through staged-fault tests. Edward Clummer, Westinghouse, described staged fault tests of some years ago. He credited them with revealing unsuspected troubles. Use of residual voltage relays to guard against false operation of ground relays on reclosure was described by W. F. Marter, Duquesne Light.

The Reardon paper drew generous comment particularly on potential transformer practices. G. E. Kimmerman, R & IE, questioned the author's wisdom of omitting fuses on potential transformers. R. S. Smithley, Duquesne Light, said his company uses bus rather than line potential to operate switches. Testing lines before opening switches has made for longer air-break sequences on his system, he said. Ohio Public Service practice is to use one breaker reclosure before any air break switch is opened, L. F. Ferri said. Three-phase potential transformers are used, especially where repeating fuses are used in conjunction with automatic air-break switch installations. Duke Power uses automatic air-break switches as back-up protection against low-tension faults on 44-kv transformer banks according to O. L. Giersch.

LOW-VOLTAGE SWITCHGEAR

A Study of A-C Arc Behavior Near Current Zero by Means of Mathematical Models. T. E. Browne, Jr., *Westinghouse.*

Curves and equations developed for behavior of idealized arc column approximating a-c power arcs in breakers and fuses.

A Compressed Air Circuit Breaker for 23-Kv Arc Furnace Duty. H. M. Wilcox and B. P. Baker, *Westinghouse.*

600 amp, 100 psi compressed air breaker for 23-kv service life tested for 30,000 operations at currents to 3,500 amp without repair or replacement of any operating element. Non-linear surge suppressor cuts surge voltage to less than 40 percent of normal.

Arcing Fault Currents in Low-Voltage A-C Circuits. C. F. Wagner and L. L. Fountain, *Westinghouse.*

Tests show a factor of 0.9 applied to bolted symmetrical fault current values in excess of 40,000 amp, and a factor of 1.0 for less than 40,000 amp, more nearly approximates arc fault currents on 500 v bus circuits than factor of 1.25 in recommended AIEE calculating method.

Field tests of four breaker types on 7,000,000 kva faults show 10,000,000 kva interrupting capacity immediately possible; higher ratings and faster reclosing speeds than 20 cycles attainable. Impulse breaker superior for breaking line charging current.

Performance Tests of AEG Free-Jet Air Blast 220 Kv 2,500 Mva Reclosing Circuit Breaker. A. Dovjikov and C. C. Diemond, *Bonneville Power Adm.*

German design fails to approach best American designs in speed of fault interruption or ability to break line charging current with little restrike. German design has 6 cycle fault interrupting time; 0.06 sec dead time; 04 sec arcing time. Line

S. H. Mortensen, Allis Chalmers Mfg Co and Frank V Smith, Sargent and Lundy

Miss Lillian M. Lawrie, AIEE Headquarters Staff with C. H. Clark, Duquesne Light Co and A. A. Johnson, Westinghouse Electric Corp

charging current interruption at 207 to 210 kv accompanied by objectionable restriking.

A. M. Cassie, ERA (British) upon whose work the Browne paper was based, in part, felt that until more experimental data is available little more can be done with mathematical analysis of arc behavior. Deductions from the paper's severity formula were derived from over-simplification, he believed. Noting "peculiarities in basic assumptions," W. F. Skeats, GE, found it questionable to specify the limiting rate of rise to which a breaker is subjected. W. M. Leeds, Westinghouse Electric Corporation, said that he found surprising agreement between Browne's deductions and experimental data on arc behavior near current zero.

Noting the laboratory nature of life tests described by Wilcox and Baker, B. W. Wyman, GE, felt their value would be improved if conducted in the dirty atmosphere of steel mills where they will be used. He likewise, questioned the wisdom of the current practice of omitting enclosures from around the interrupters.

Discussers of the Wagner-Fountain paper generally agreed that bolted-fault currents should form the basis for low-voltage breaker selection rather than any lower value. C. H. Black and A. E. Anderson, GE, cautioned that conclusions regarding current limiting action of the arc should not be heavily weighted and that protection against less than bolted-fault currents involved a risk. D. L. Beeman, GE, pointed out that short circuit arcs are erratic and that use of reducing factors to account for arc drop is not wise. Bolted fault currents sometimes do occur, protection against less would lead to widespread mis-application of their designed function, he believed.

HIGH-VOLTAGE SWITCHGEAR

A 230-Kv 3-Cycle Oil Circuit Breaker for Extra-Heavy Arc Rupturing Duty. W. M. Leeds and G. B. Cushing, *Westinghouse.*

Laboratory and field test justify confidence in oil breaker design for 10,000,000 kva 3-cycle interrupting duty at 230 kv at Grand Coulee. Momentary currents of 34,000 amp impells use of copper-alloy arcing contacts for more conductivity and ruggedness. Multi-flow arc interruption principle employed.

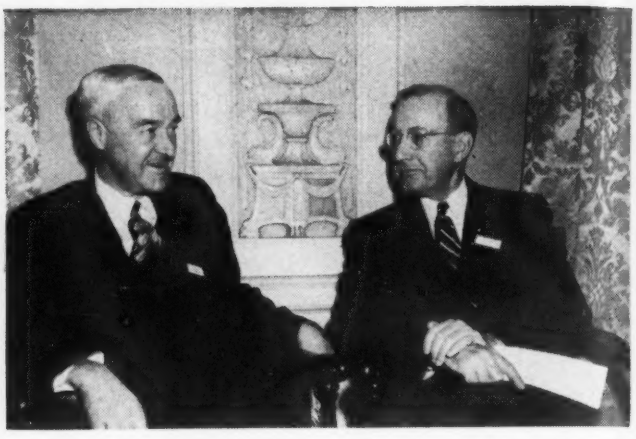
Unusual Performance of Standard 230-Kv Impulse and Tank Type Oil Circuit Breakers on Field Tests. E. B. Rietz, *GE.*

Field tests prove ability of standard 3,500,000-kva 230-kv low-oil-content impulse and tank-type breakers to interrupt twice rating without distress. Ratings of 7,500,000 kva easily obtainable; 10,000,000 breakers possible with slight design changes. Line charging currents best interrupted with impulse breakers.

Field Tests for Development of 10,000,000 230-Kv Oil Circuit Breakers for Grand Coulee Power Plant. C. L. Kilgore and W. H. Claget, *U.S. Bureau of Reclamation.*

Philip Sporn and H. P. StClair, American Gas & Electric, found evidence in the Grand Coulee field test that breaker derating factors are no longer necessary. Elimination of the transient over-voltage problem, evident in the tests, were seen as opening a new field for development. They warned that resistors used to keep down restrikes may lengthen arcing time. A compromise is indicated. Superiority of stored-energy breakers for eliminating restrikes was noted and the comment made that they appear to offer the best possibilities in the high-voltage field. Lloyd Hunt, Southern California Edison, T. M. Blakeslee and J. P. Stratford, Dept. Water & Power, Los Angeles, noted that test kva took into account the maximum dc component, allowable under section C-37 of the test code. This high d-c component, it was felt, made the test less severe than it appeared to be. Stratford reported that increasing duty on 138-kv breakers on his system had increased the duty on lower-voltage breakers. He wondered if this might be expected at Grand Coulee, also. B. W. Wyman, GE, commenting on testing of the single-pole tank-type breaker, noted the use of two values of resistors and the fact that with the lower resistance the breaker arced during 93% of the stroke. The higher ohmic resistance while reducing arcing permitted restrikes, he pointed out. M. H. Hobbs, Westinghouse, confirmed the elimination of arcing with high ohmic resistor across breaker contact pointing out that only two restrikes resulted. In his view, performance of high capacity breakers in breaking charging current is not as important as fault interruption. De-rating factors are now proven unnecessary, he felt. Minimum reclosing time of 12 cycles on arcing faults is now fixed by system rather than equipment limitations, he pointed out. Closure of the Kilgore-Clagett paper revealed that high d-c components in test kva permitted somewhat higher fault currents than would have been otherwise available.

L. W. Smith, Doble Engineering Co, W. W. Ege, Copperweld Steel Co and C. H. Kreger, Public Service Co of Northern Illinois



A. C. Streamer, Westinghouse Electric Corp and E. P. Yerkes, Bell Telephone Co of Pennsylvania

TRANSMISSION AND DISTRIBUTION

10,000 Kva Series Capacitor Improves Voltage on 66 kv Line Supplying Large Electric Furnace Load. B. M. Jones, J. M. Arthur and C. M. Stearns, *Duquesne Light* and A. A. Johnson, *Westinghouse*.

Details system studies justifying installation of world's largest series capacitor to correct voltage and flicker condition caused by fluctuating arc furnace load. Resonant condition found on test under certain load conditions. Shunt resistor installed across capacitor to prevent low-frequency resonance conditions when starting 4,000 hp motor at small plant loads.

Design and Layout of 66-Kv, 10,000-Kva Series Capacitor Substation. G. B. Miller, *Duquesne Light*

Describes design and layout problems encountered in the construction of substation for 10,000 kva 66 kv series capacitor.

Design and Protection of 10,000-Kva Series Capacitor for 66-Kv Transmission Line. A. A. Johnson and R. E. Marbury, *Westinghouse*, and J. M. Arthur, *Duquesne Light*.

Three groups of 80 15-kva 2,400-volt capacitors in series per phase make up series capacitor for one phase of 66-kv line supplying arc furnace and heavy motor load; normal current rating 500 amp. Gaps and by-pass switches protect against overvoltage on line fault.

Transient Shaft Torque in Turbine Generators Produced by Transmission Line Reclosing. J. W. Batchelor, D. L. Whitehead and J. S. Williams, *all Westinghouse*.

Equations developed with analog computer evaluate torques in turbine generators during reclosing or synchronizing. Curves show crest transient torques developed for various angles of synchronization.

First three-month's operation of the 10,000-kva series capacitor has reduced voltage dips and given better voltage balance and regulation at the load, Leonard Olmstead, Duquesne Light, reported. Burning of bellows on the short circuiting contactors has resulted in some modification of design, he revealed. H. C. Bartholemew and P. M. Black, Illinois Northern Utilities, reported solution of a similar arc furnace voltage problem with a 2,880 kva series capacitor at Freeport, Ill. No trouble was experienced with subsynchronous self excitation at this installation. J. W. Butler, GE, suggested quadrupling ohmic resistance in parallel with capacitors to cut down losses. A. G. Darling, GE, described a series capacitor installation of the Braydon Copper Co, Chile, which reduced voltage variation by half in a strikingly similar installation. Dated from 1939, it was cited as the first known attempt to correct arc-furnace voltage regulation with series capacitors. J. S. Brown, Duquesne Light, called attention to successful use of air-break by-pass switches instead of breakers. After 20 operations arcing horns were not seriously burned. E. E. Starr, Oregon State College, reported studies in progress in the Northwest on large series capacitors for compensation of long high-voltage transmission lines. Regarding the problem of sub-synchronous self-excitation of motors served by the capacitor, Starr suggested pulling the capacitor out of service during motor starting, rather than resorting to involved and expensive measures to correct for it. In closure, B. M. Jones, Duquesne Light, indicated that higher ohmic resistances would be adopted progressively as it was found that they were practicable and did not further complicate the motor starting problem. R. E. Marbury, Westinghouse, in closure, traced bellows failure to repeated gap flashover during false motor starting. Flashovers caused bellows to expand rapidly, buckle, and bring convolutions into contact, drawing arcs that damaged the bellows.

SUBSTATION CONFERENCE

Discussion at the Friday conference on substations centered around comparative merits of a-c and d-c tripping schemes. K. B. Hoffman, Burns and Roe, favored battery-powered d-c tripping for reliability reasons. He called for introduction of war-time developments into this field citing in particular a lightweight Edison type battery developed for unattended life-buoy blinker service, and a flea-power motor generator set developed for radar use. C. E. Winegartner, Cleveland Electric Illuminating, described an automatic a-c tripping scheme for operating line sectionalizing breakers in remote unattended substations. Its success, he felt, demonstrated feasibility of a-c for this type service. Most of the a-c trip schemes used by Southern California Edison for small stations were described by Cort Lowerison. Capacitor tripping is not used and potential transformer applications while numerous are not general, he said. Series or plunger trip is used strictly as instantaneous trip means. In no case is it used for time delay.

M. E. Reagan, Westinghouse, presented a general review of a-c and d-c tripping methods for small distribution substations. J. R. Palmer, GE, discussing coordination of protective devices for control of power circuits favored fuses over thermal

breakers because of better selectivity. Coordination of protection is limited by the instantaneous trip thermal breakers at higher current values, he asserted. In discussion Lloyd Hunt, Southern California Edison, reported experimentation with a nickel cadmium battery of low internal resistance that "can't be overcharged." Robinson, Toledo Edison, said his company has been using "B" battery tripping successfully for 15 years. K. N. Reardon, West Penn, expressing preference for battery tripping said his company had shifted from 24- to 48-volt battery potential. "B" batteries were tried but dropped.

HEAT PUMPS

The Heat Pump from the Utility's Point of View. S. W. Andrews, *Amer. Gas & Elec.*

Heat pump's lower consumption and demand compared with resistance heaters and consequent conservation of investment in utility plant required to serve coupled with higher load factor (30 vs 10) makes heat pump more attractive for house heating.

Electric House Heating Tests In Oregon. W. L. Sharp and A. E. Opdneweyer, *Portland General Elec.*

Tests of 75 resistance heated installations show that maximum demand is 50-57 percent of connected load during daily two-hour heating peak; diversified demand 30 to 40 percent of connected on system peak; 30 percent annual load factor higher than estimates due group diversity and summer use.

Three conference papers ably supplemented the two formal papers at Friday's house heating symposium. Constantine Bary, Philadelphia Electric, emphasized the fact that heat pumps will increase consumption of average residential customers about 17 times, and range and water heater customers three times. It will not improve utility load factor, he asserted and heat pump load may require a higher rather than a lower service rate. To make it a commercial reality the heat pump needs serious research on heat sources. Efforts are also needed, he said, to improve efficiency and overcome undesirable electrical characteristics. K. W. Miller and N. C. Penfold, Armour Research Foundation, made a strong case, in their joint paper, for diesel and gas engine drives for heat pumps, pointing out that exhaust heat can supply some of the heat load through an exchanger, that the coefficient of performance for the engine will thus be 1.5 against 3.0 for motor drive and that compressors of about reduced size will be possible. D. W. McLenegan and G. W. Brown, GE, suggested that air as a medium in combination with heat storage offered better heat source possibilities than either earth or well water. Data was presented showing that it gives a higher load factor and lower demand than comparable sources.

LIGHTNING AND GROUNDINGS

Present-day Grounding Practices on Power Systems. Committee report.

Trend in system grounding on 460 generating stations (33,752 Mva) and 567 transmission and distribution systems (119,081 miles) shows preference for resistance grounding for stations and solid grounding for lines.

Survey of Lightning Protective Equipment for Rotating A-C Machines. Committee Report.

Preponderance is for arrester and capacitor; half as many utilities rely on either this combination or arrester alone. Less tendency to protect generators connected to buses or underground cables.

Expulsion-type Lightning Arresters Impulse Sparkover Volt-time Characteristics. Committee report.

Affords curves for distribution arresters 3 to 15 kv covered by AIEE Standard No. 47.

Interpretation of the committee report by A. A. Johnson (Westinghouse) disclosed that one-tenth of the utilities see new trends in generator and system-grounding practices. Half the companies with wholly ungrounded systems admit unsatisfactory performance. Solid grounding of generators not supplying feeders directly is less favored and reactance grounding is increasing in favor. The general conclusion is that the evident differences in schools of thought warrant a thorough study of the merits and limitations of the various methods.

Two modified forms of resistance grounding were mentioned. M. S. Schneider (Cincinnati Gas & Electric) uses a distribution transformer with resistance across the secondary to ground the neutral of a transformer directly connected to a generator. R. G. Hook (Public Service Electric & Gas) reported a 1300-ohm (primary effective) value for grounding a new generator, the objective being protection of generator laminations in case of a fault to ground. This is done despite some loss in protection selectivity between the two banks fed by the generator for the sake of holding neutral fault current to 6 amperes.

J. A. French and Milton C. Mapes, Wescott and Mapes, Inc

In connection with the report on lightning protection of generators E. Beck of Westinghouse hoped that corresponding data could be made available from and to industrial and public power because they both have comparable, if not greater, exposures.

Definite decrease in alternator damage was achieved after applying arrester protection on the Chicago system said E. H. Grosser. Arresters are installed on all but one line except those having long cables.

TELEMETERING

The Problem and Telemetering Systems Considered. R. G. Meyerand, *Union Elec.*

Impulse duration form chosen. Ten audio tones 150 to 2900 cycles; duplexing affords 20 channels. Facilitates load allocation, hydro control, planned outages, emergency warnings, operator efficiency, provision of proper reserves.

A Faster Telemeter for Carrier Current Channels. E. E. Lynch, H. C. Thomas and G. S. Lunge, all *GE.*

Watthour meter generates 6 to 27 cycle frequency and the particular frequency transmitted is proportional to the telemetered quanity. Receiver is modified frequency meter.

New Devices Derived from a Torque Balance Telemeter. W. H. Burnham. *GE.*

Dispatcher uses 'Load Injector" to advise operator what load to carry. Conversion of channel (d-c) milliamperes to a-c affords summation and integration on induction watthour meter.

METALLIC RECTIFIERS

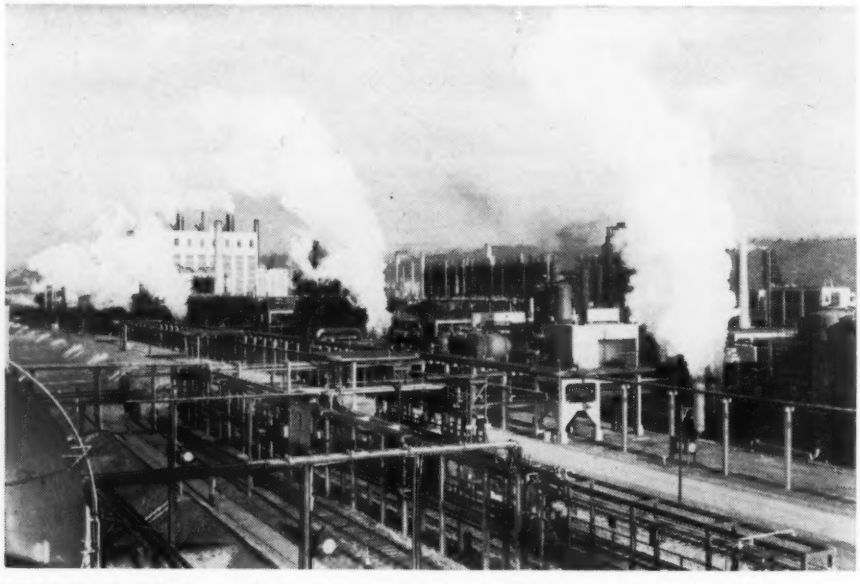
Twenty-five Years of Copper-Oxide Rectifiers. L. O. Grondahl, *Union Switch and Signal.*

A review of the history, theory of operation, and progress in development of copper oxide rectifiers in the 27 years since its origin.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Exhaust Steam Noise Quieted by Silencers



SILENCERS QUIET NOISE made by exhausting 1,000,000 lb per hr of low-pressure steam from 35,000-kw noncondensing industrial turbine connected to utility system. Location of silencers is indicated by steam plumes. Plant is visible in background

SILENCING THE ROAR made by a million pounds per hour of low-pressure exhaust steam is an engineering job with substantial public relations twist.

It was solved in Pittsburgh, recently, when Duquesne Light Company arranged to buy the output of a 35,000-kw noncondensing turbo-generator at a war-born industrial plant to increase its margin of reserve generating capacity.

The turbo-generator was part of the Kobuta Chemical Plant, Kobuta, Pa. built with RFC funds during the war and operated by the Koppers Co to make butadiene and styrene for the synthetic rubber program that was underway at that time.

Rating of the machine was 35,000 kw with steam at 700 psi and 750 F and a back pressure of 165 psi. Exhaust steam was used in the chemical process during the war. But with the coming of peace, demand for the chemicals fell off and the process was modified. Process demand for exhaust steam has since been too small to warrant operating the turbine at such low output.

In mid-1947 Duquesne Light Co, anticipating a need for more reserve generating capacity while its own station additions were building, arranged to buy the output of the Kobuta unit from Koppers at the generator terminals.

Noncondensing Operation

This meant that the unit would have to be operated noncondensing with as much as 1,000,000 lb per hour of low-pressure steam exhausted to atmosphere. Exhausting this much steam could easily have created a noise nuisance. Opening of the turbine relief valves had previously made enough noise to be almost intolerable a mile or more away! Some type of silencer was necessary.

A test of one commercial type by Koppers, at another plant, indicated that the nuisance could be eliminated.

Accordingly, 16 exhaust silencers, each four feet in diameter and 14 ft high, rated 50,000 lb per hr were located in groups of four along two 24-in. yard distribution headers so steam would be discharged at successive points up to 1,600 ft from the generating plant.

Operation of the silencers has been completely successful even at steam flows above rating. Sound is now well below the general sound level at the plant and entirely negligible.

But there were other problems. The small process steam demand made it impracticable to operate the turbine at its rated back-pressure of 165 psi. The back pressure valve was not adequate for this purpose. The machine is therefore operated with exhaust open to atmosphere and back-pressure established only by piping friction. As a result of the larger pressure-differential across the turbine the steam rate is reduced from 30 to about 20 lb per kwhr.

Improvement in the economy of the cycle was studied. It was found that the turbine casing has an extraction opening which was not used since the intended operation did not require extraction. However, simple piping changes will permit process steam needs to be supplied through this extraction opening. This will reduce the steam quantity exhausted to atmosphere and should reduce fuel consumption about 20 percent at maximum load.

Operation of the plant has been successful. Ability to take and drop load as ordered by the Duquesne Light Company's system operator has proved to be very flexible. The 35,000-kw generator carries 41,000 kw regularly on Duquesne Light Co system peaks.

Straightener Designed for Reeled Wire

THOMAS BURGESS
Foreman, Electrical Maintenance Dept
New Bedford Gas and Edison Light Co
New Bedford, Mass.

THE SHEAVE-TYPE wire straightener illustrated has been used to install No. 4/0 H. D. copper trolley wire. As this wire passes over and under the sheaves, a kneading action takes place which tends to straighten the wire. Approximately 25 percent less time is required to unreel, straighten, pull in and support the wire than was required heretofore.

Previously wooden blocks and mallets were used in an effort to straighten the conductor after it had been supported. That method was time-consuming and usually did not give very good results.

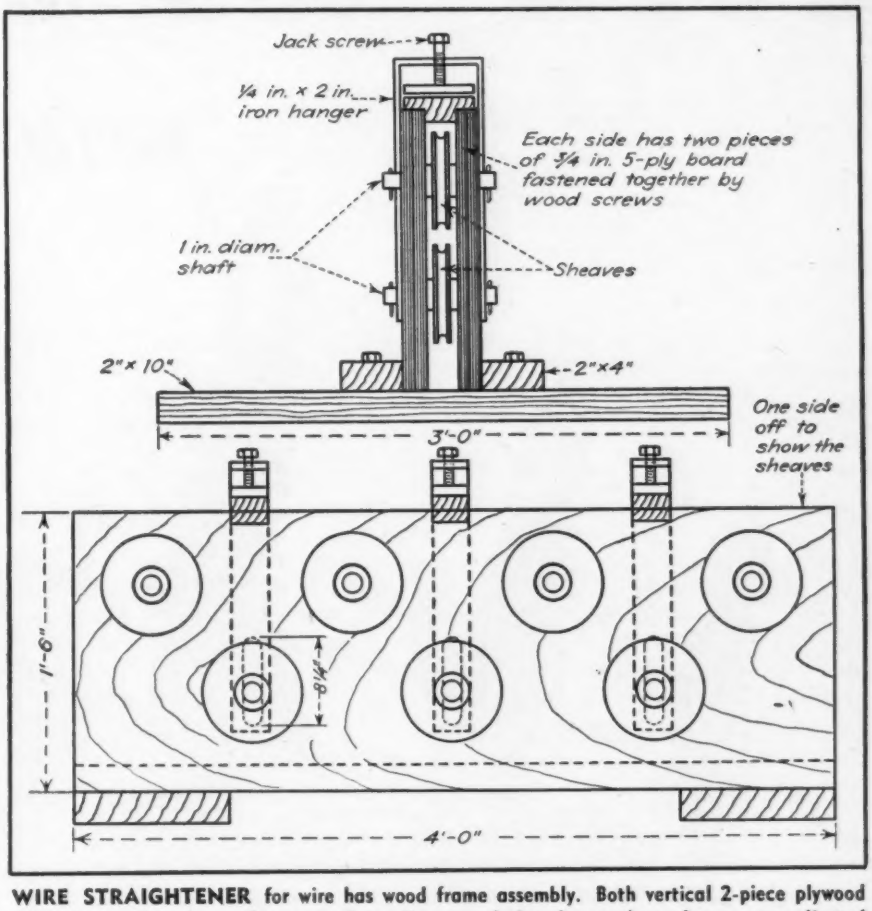
In constructing the straightener, two plyboard side members 4 ft × 1-½ ft serve as a support and a guide for the sheaves. Two 2 × 4 in. and two 2 × 10-in. wood pieces are mounting members. Bolt construction is used for easy assembly and dismantling the latter for storage.

The seven 6-in. brass sheaves are standard trolley collector wheels. Four sheaves form a top row and have shafts in a fixed horizontal position. The three sheaves forming the lower row are supported on hangers of ¼ × 2-in. iron. Positions of latter sheaves are adjusted by jack screws at top of the hangers.

A spreader block of wood is used to keep the top sheaves from binding between the side members and also to serve as a filler under the jack screws. A close clearance must be maintained between the sides and the sheave hubs to prevent the sheaves from weaving.

In use, the straightener should be braced to withstand a pull of about 500 lb.

The reel of wire is anchored in position close to the device and directly in line with it. The jacks on the straightener are loosened to their full length to enable the wire to be started through the sheaves. Then the jacks are drawn so that sufficient tension is applied to require two men to pull the wire through the straightener. The wire is fastened to a truck for pulling. As much as 500 ft of wire has been pulled out continuously in a straight condition and ready to be installed.



WIRE STRAIGHTENER for wire has wood frame assembly. Both vertical 2-piece plywood sides support 6-in. brass sheaves on 1-in. diameter shafts. Lower three sheaves are adjusted by jacks. Wire is drawn horizontally between the two rows of sheaves.

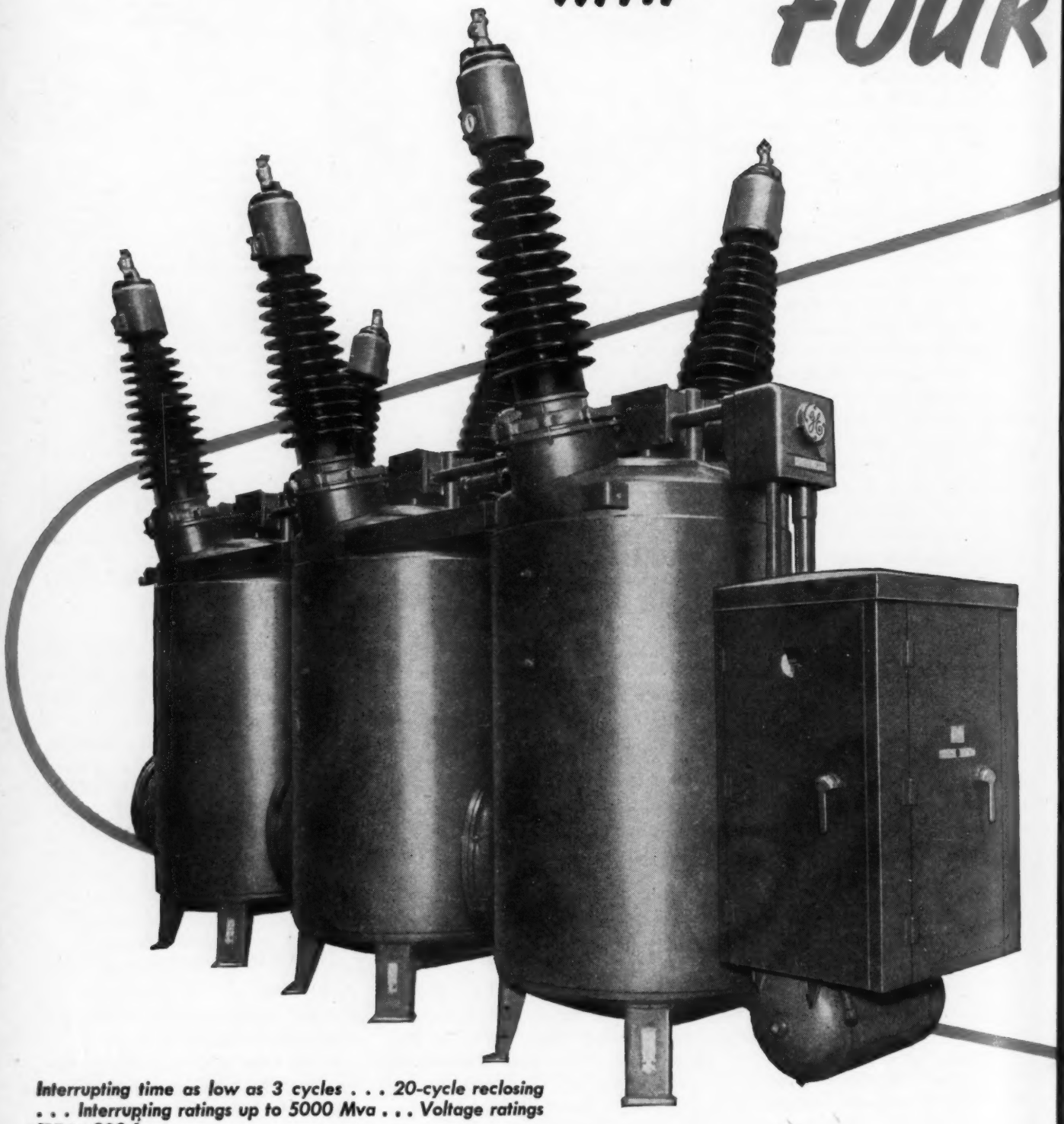
• • •

Motor Location Factor in Heavy Service

THE EXPOSURE of a-c motors driving heavy sheet steel mills to iron dust needs more consideration. A 1,400-hp motor driving an 84-in. mill installation developed a short-circuit in three stator coils. These coils were replaced with spares. A 3-kv potential test showed that four more coils were shorted or failed on test. Reinsulation followed and service was resumed. The motor was located in a room having many openings near two rolling mills which it drove, and serious exposure to iron dust existed. The motor was also in a relatively hot part of the plant, and except for one ventilating fan arranged to blow out of one of the windows there was no forced ventilation. It was therefore decided to reduce these exposure conditions and increase the ventilation facilities.

In the same plant a 20-hp a-c motor drove a tilting mechanism for a furnace to pour molten steel. The gearing between the motor and the furnace became bent, causing an overload on the motor when the time came to pour. A motor burnout resulted. This was attributed to over-

TYPE "439" OIL-BLAST WITH FOUR



Interrupting time as low as 3 cycles . . . 20-cycle reclosing . . . Interrupting ratings up to 5000 Mva . . . Voltage ratings 115 to 230 kv

BREAKERS

NEW FEATURES

The FK-439 is the latest development in a long line of General Electric heavy-duty outdoor breakers. Besides interrupting time of either 3 or 5 cycles (with 20-cycle reclosing), this new unit also brings you many outstanding design features including—

1

COMPLETELY SEALED BUSHINGS

Maintenance is reduced to a minimum by having the bushings completely sealed from the atmosphere. Compact design with the porcelain parts held in compression assures reliability and strength. A magnetic-type oil-level indicator is easily visible from the ground. Experience with over 80,000 moderate-voltage sealed bushings gave General Electric the proper background for developing these completely sealed bushings for high voltage apparatus.

2

SIMPLIFIED INTERRUPTER

Light weight and simplified construction of the multi-break interrupter assures faster circuit interruption for greater system stability. Improved performance characteristics have been thoroughly confirmed by field tests. Contact maintenance is almost negligible because of arc-resisting contact materials.

3

SELF-CONTAINED AIR MECHANISM

High-speed reclosing is accomplished by the smooth, positive action of the pneumatic mechanism. This type of apparatus is completely self-contained. Pneumatic operation means lower control power requirements resulting in smaller batteries and control leads. Electrical and pneumatic controls are readily accessible through the three hinged doors of the mechanism housing.

4

IMPROVED TANK CONSTRUCTION

Sturdy leg-type tank supports facilitate inspection and painting under the tank, and permit a reduction in the size of the foundation pads. Large side manhole openings provide convenient accessibility to the interior of the tank. This not only permits ready inspection of the interrupters but also easy removal of the bushing current transformers. New design features throughout the breaker have resulted in a reduction in tank dimensions and overall unit weight.

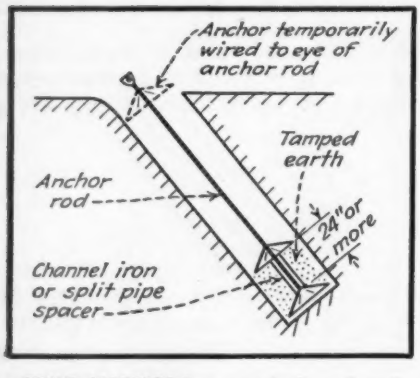
Your nearest G-E sales representative has additional information on the Type FK-439 oil circuit breaker. Write for bulletin GEA-4407 which gives further details. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

fusing the motor in order to apparently insure continuous operation through the critical pouring period. While location was but a minor factor, if any, in this accident, the importance of complete inspection of motor and drive equipment prior to pouring each heat was emphasized.

•

Two Anchors In Tandem Give Extra Holding Power



TWO ANCHORS on a single rod and in the same anchor hole approximate the holding power of a single large anchor

JOHN GIBSON
Jenkinstown, Pa.

PUTTING TWO SPREADER-TYPE anchors on a single rod is a convenient way to get extra anchor holding power in a single hole. While it is doubtful that this use of two anchors in "tandem" will double the holding power, it does increase the holding power substantially. It also offers a means of approximating the holding power of a large anchor (which may not be available) with two smaller ones.

Installation Procedure

The method of installation is illustrated in the accompanying sketch. After the anchor hole has been dug to proper depth, one of the two anchors is slid over the rod and wired temporarily to the eye. The second is fastened to the bottom of the rod in the usual manner. A 24-in. spacer made either of split pipe or channel iron is next slipped in place atop the lower anchor and earth tamped in firmly around it. The top anchor is then cut loose from the eye of the rod and allowed to drop into place before the balance of the hole is backfilled and tamped.

UTILITIES IN THE UNITED STATES
Having Generating Capacity Other Than 60 Cycles

State	Nearest Community	Utility	Plant	Type	Capacity Kw	Cycles
Ariz.	Tempe	Salt River Valley Water User's Assn	Crosscut	Steam	22,500	25
				Int C	10,000	25
				Hydro	2,100	25
"	Roosevelt	" " " " "	Horse Mesa	Hydro	30,000	25
"	Mormon Flat	" " " " "	Mormon Flat	Hydro	7,000	25
"	Roosevelt	" " " " "	Roosevelt	"	15,400	25
"	Mesa	" " " " "	So. Consolid	"	1,600	25
"	"	" " " " "	Stewart Mount	"	10,400	25
Calif.	Fresno	Southern California Edison Co*	Big Creek #1	"	67,000	50
"	"	" " " "	Big Creek #2	"	57,750	50
"	"	" " " "	" " #2A	"	80,000	50
"	"	" " " "	" " #3	"	75,000	50
"	"	" " " "	" " #8	"	54,000	50
"	Kernville	" " " "	Kern Borel	"	8,200	50
"	San Bernardino	" " " "	Fontana	"	1,920	50
"	Bakersfield	" " " "	Kern River #1	"	16,500	50
"	Long Beach	" " " "	Long Beach	Steam	366,000	50
"	Redlands	" " " "	Mill Creek #2 & #3	Hydro	2,000	50
"	"	" " " "	Santa Ana River #1	"	2,400	50
"	"	" " " "	" " " #2	"	800	50
"	"	" " " "	" " " #3	"	1,500	50
"	Vernon	" " " "	Vernon City	Int C	30,000	50
"	San Bernardino	" " " "	Lytle Creek	Hydro	400	50
"	Redlands	" " " "	Mill Creek #1	"	600	50
Colo.	Pueblo	Southern Colorado Power Co	Pueblo	Steam	18,968	30
D. C.	Washington	Potomac Electric Power Co	Benning	"	50,000	25
Ill.	Chicago	Commonwealth Edison Co	Fisk	Steam	126,000	25
Iowa	Fraser	Ft Dodge, Des Moines & So RR	Fraser	"	20,000	25
"	Keokuk	Union Electric Power Co	Keokuk	Hydro	105,600[a]	25
"	Des Moines	Des Moines Railway Co		Steam	13,000	25
Kan.	Lowell	Empire District Electric Co	Lowell	Hydro	3,000	25
"	Riverton	" " " "	Riverton	Steam	46,500	25
Ky.	Louisville	Louisville Gas & Elec Co	Canal	"	12,000	25
La.	New Orleans	New Orleans Sewerage Wtr Bd	Pwr House #2	"	27,000	25
Me.	Milford	Bangor Hydroelectric Co	Milford	Hydro	6,080	25
"	Stillwater	" " "	Stillwater	"	1,680	25
"	Rumford	Rumford Falls Power Co	Upper Station	"	24,000	50
"	"	" " " "	Island Station	"	5,775	50
Md.	Baltimore	Consolidated Gas Elec Lt & Power Co of Baltimore	Westport	Steam	120,000	25
Mass.	Florida	New England Power Co	Deerfield #5	Hydro	9,000	25
Mich.	Newaygo	Consumers Power Co	Croton	"	9,000	30
"	S. Ste. Marie	Michigan Northern Pwr Co		"	38,800	25
Minn.	Tomson	Minnesota Power & Lt Co	Tomson	"	33,750	25
Mo.	St. Louis	Union Electric Co	Ashley St	Steam	44,000[b]	25
Nev.	Boulder City	U. S. Bureau of Reclamation	Hoover Dam	Hydro	247,500[c]	50
N. J.	Jersey City	Public Service Elec & Gas Co	Marion	Steam	18,000	25
N. Y.	Brooklyn	Consolidated Edison Co	Gold St.	"	71,000	25
N. Y.	New York	" " "	East River	"	280,000	25
"	" "	" " "	Hell Gate	"	105,000	25
"	" "	" " "	Port Morris	"	60,000	25
"	" "	" " "	Waterside #1 & #2	"	162,200	25
"	" "	" " "	Long Island City	"	89,100	25
"	Albany	New York Power & Light Co	Riverside	"	7,500	40
"	Cohoes	" " " " " "	School St	Hydro	7,200	40
"	Niagara Falls	The Niagara Falls Pwr Co	Adams	"	80,000	25
"	" "	" " " " "	Schoellkopf	"	262,800	25
"	Massena	St Lawrence River Pwr Co	Massena	"	7,750	25
"	Fulton	Central New York Pwr Co	Granby	"	2,972	25
"	Newfane	Buffalo Niagara Electric Co	Burt	"	4,000	25
"	Waterport	" " " "	Waterport	"	2,400	25
"	Tonawanda	" " " "	Chas R Huntley #1	Steam	305,000	25
"	Orwell	" " " "	Bennetts Bridge	Hydro	11,200	25
"	Schenectady	General Electric Co	Schenectady	Steam	20,000	40
"	New York	New York City Transit System	Williamsburg	"	220,000	25
"	" "	" " " " "	59th Street	"	195,000	25
"	" "	" " " " "	74th Street	"	180,000	25
N. C.	Badin	Carolina Aluminum Co	Yadkin Falls	Hydro	13,300	36
"	"	" " "	Yadkin Narrows	"	56,200	36
Ohio	Toledo	Toledo Edison Co	Acme	Steam	50,000	25
"	"	" " "	Water St	"	26,080	25
Pa.	Scranton	Lackawanna & Wym. Valley Pwr Co	Scranton	"	3,000	25
"	Hauto	Pennsylvania Pwr & Lt Co	Hauto	"	30,000	25
"	Holtwood	" Wtr & Pr Co	Holtwood	Hydro	87,000	25
"	Philadelphia	Philadelphia Electric Co	Schuylkill	Steam	65,000	25
"	Safe Harbor	Safe Harbor Water Pwr Corp	Safe Harbor	Hydro	60,000[d]	25
S. C.	Columbia	So Carolina Elec & Gas Co	Columbia	"	1,750	40
"	Union	Union Manufacturing & Pwr Co	Neal Shoals	"	5,200	40
Tex.	Ft. Worth	Texas Electric Service Co	Handley	Steam	6,400	25
Wis.	Milwaukee	Wisconsin Elec. Pwr Co	Commerce St	Steam	15,000	25

*The 50-cycle system is currently being converted to 60-cycle operation.
[a]14,400 kw to be rewound for 60 cycle in 1948.
[b]24,000 retired in 1947.
[c]Units interchangeable for either 50 or 60 cycle operation.
[d]Single phase.

GENERAL ELECTRIC REPORTS ON COMPLETE SEALING TO PROLONG OIL LIFE

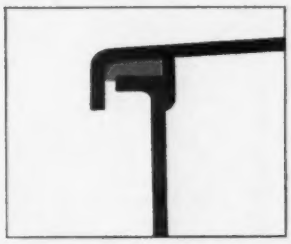
Sealed tanks, long a feature of G-E power transformers, are now used in Spirakore distribution transformers to prevent moisture from contaminating the oil.

Every opening in the Spirakore sealed-tank transformer—cover, handhole, and bushings—is sealed with a Buna-N rubber gasket. No cement or sticker is used. Compression of the rubber within a confining area forms an air-tight seal—without affecting accessibility.

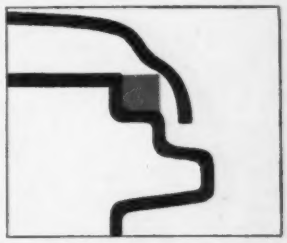
This complete sealing should not be confused with splashproof construction. Splashproof transformers are gasketed to prevent oil leakage during shipment and handling, but are not air-tight—they do breathe, and in breathing draw in moisture-laden air.

Spirakore sealed-tank transformers *do not breathe.* Their Buna-N rubber gaskets—unharmed by oil, by age, or by operating temperatures—keep atmospheric air, moisture and other contamination out.

The sealed-tank construction in G-E pole-type distribution transformers is described in new bulletin, GEA-4885. For your copy, write to Apparatus Department, General Electric Co., Schenectady 5, N.Y.



On large tanks, Buna-N rubber gasket of circular cross-section is compressed as shown. A ring welded to the tank keeps the gasket in place and prevents too much compression.



On small tanks, Buna-N rubber gasket of square cross-section is compressed between rim of cover and deep-rolled flange on tank. Shown uncompressed.

Spirakore Transformers

GENERAL ELECTRIC

402-72

Compensator Setting Chart For Feeder Voltage Regulators

P. E. BENNER
Central Station Engineering Divisions
General Electric Co.
Schenectady, N. Y.

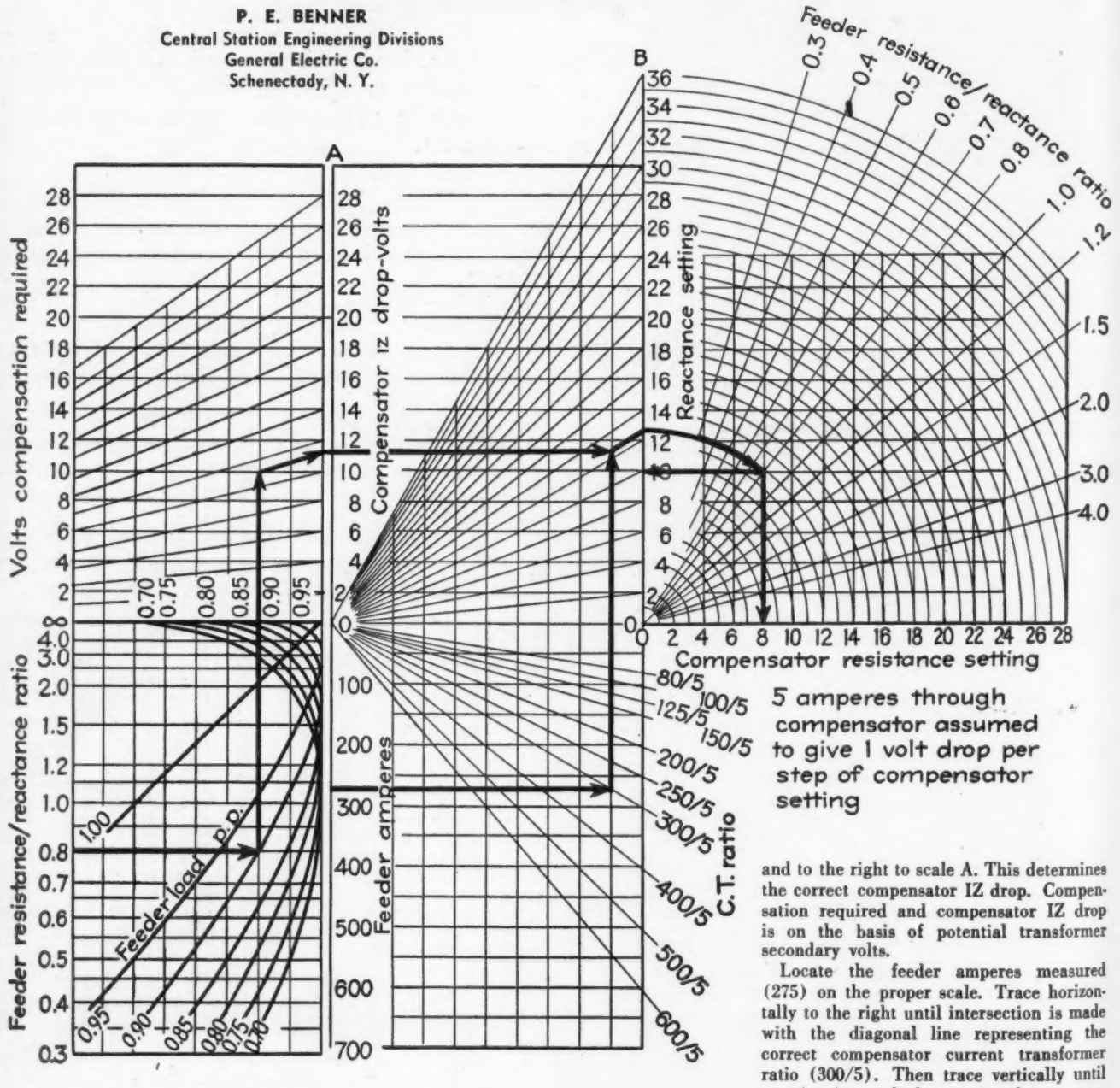

Volts compensation required
Feeder resistance/reactance ratio
Compensator IZ drop-volts
Feeder amperes
Reactance setting
Compensator resistance setting
Feeder resistance/ reactance ratio
C.T. ratio
Feeder load P.F.
5 amperes through compensator assumed to give 1 volt drop per step of compensator setting

Chart provides a graphic method of determining the settings for the resistance and reactance dials of a line drop compensator for any value of compensation at the load center at any load current and power factor. It can be used for a regulator having any potential transformer ratio. But the volts compensation desired at the load center must be determined by using the same potential transformer ratio as for the regulator.

With specific information available (indicated in parentheses) refer to the compensator setting chart and proceed as follows: Locate the feeder resistance/reactance ratio (0.8) on the scale designated. Trace horizontally to the right until intersection is made with the curve of feeder load power factor (0.9). From there, trace vertically until a point is reached opposite the volts compensation required (10 volts). Then follow the diagonal guide lines up and to the right to scale A. This determines the correct compensator IZ drop. Compensation required and compensator IZ drop is on the basis of potential transformer secondary volts.

Locate the feeder amperes measured (275) on the proper scale. Trace horizontally to the right until intersection is made with the diagonal line representing the correct compensator current transformer ratio (300/5). Then trace vertically until a point is reached opposite the compensator IZ drop. From this point follow the radial guide lines upward and to the right to scale B, and then trace along the circular guide lines in a clockwise direction until intersection is made with a radial line corresponding to the feeder resistance/reactance ratio. The coordinates of this point are the compensator settings required. The vertical scale shows the reactance setting; the horizontal scale the resistance setting.

DISCONNECTING-SWITCHES

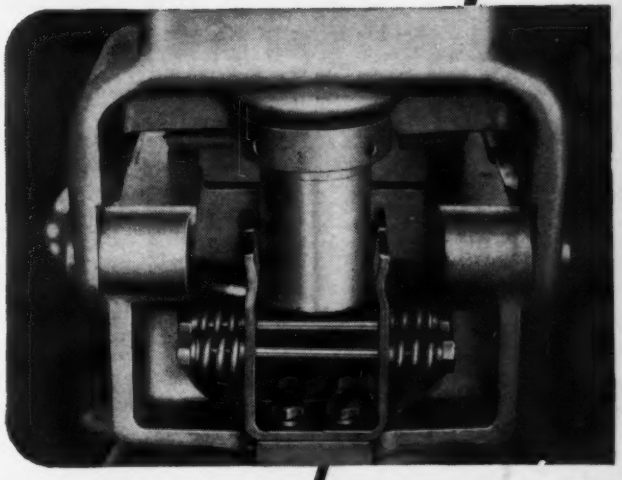
WITH SILVER-TO-SILVER LINE PRESSURE CONTACTS

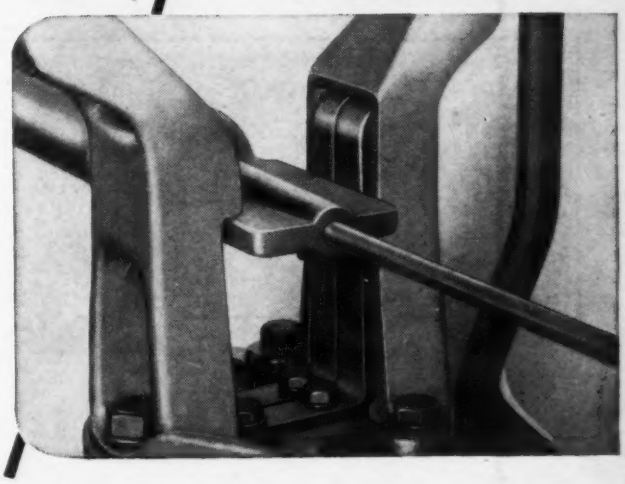
NO CURRENT-CARRYING BRAIDS as silver-to-silver contacts are used for *all* current-carrying duties. At the hinged end the silver surface of the movable blade contacts the silver surface of a U-shaped clip. Adjustable, stainless steel compression springs back the clip. This feature on the RF assures a positive contact at *all* times and eliminates *any* burning of the switch.

NEW OPERATING MECHANISM has no cams, is of simplified construction. Anti-friction bearings are used on all main moving parts . . . "Dual Operation" feature rotates the blade as it enters the stationary contacts. This action firmly forces the blade against the contacts under all weather conditions. The turning motion also locks the blade against the lip of the contact housing . . . Over-travel of the rotating insulator stack is possible without causing any additional rotation of the blade. This feature eliminates any critical adjustment of the operating mechanism . . . and no critical adjustment is necessary after the switch is installed as the three poles of the switch are easy to mount and line up.

CONTROLLED CONTACT PRESSURE eliminates unnecessary scoring and excessive wear on the silver contact surfaces . . . The stationary contact consists of U-shaped copper fingers backed by individual non-current carrying stainless steel springs . . . And remember—silver-to-silver line-pressure contacts are used throughout on the new RF braidless disconnecting switch.

See your nearest G-E sales representative about the new RF disconnect. Write for bulletin GEA-4980. *Apparatus Department, General Electric Company, Schenectady 5, New York.*





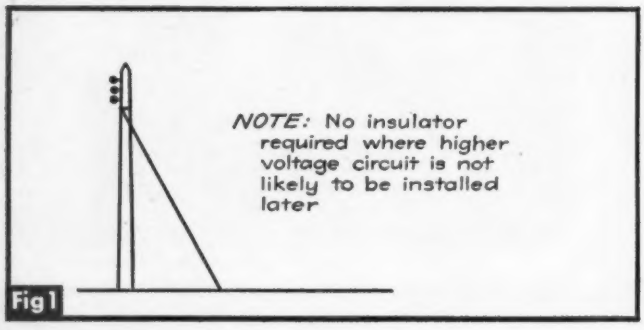
GENERAL ELECTRIC

853-1

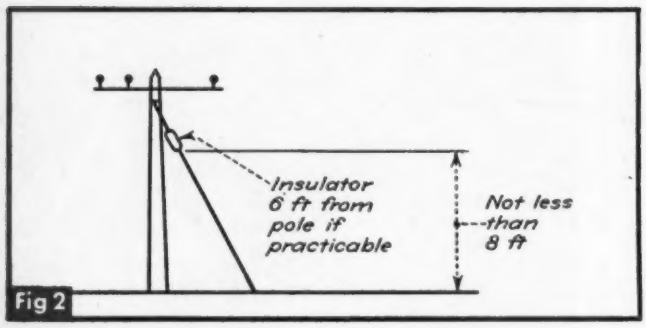
Guy and Strain Insulator Arrangements For Urban Line Construction

Typical installations of strain insulators for ungrounded guys on lines up to 15 kv; adapted from standards of Tennessee Valley Power Distributors Association, Chattanooga, Tenn.

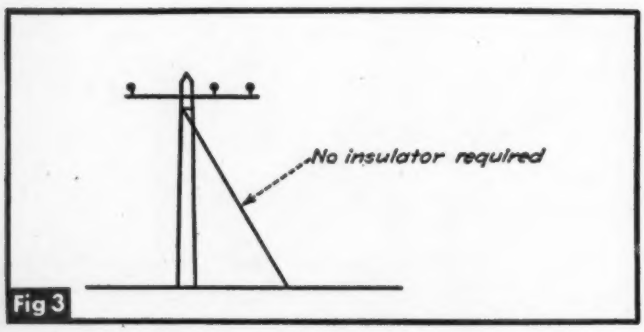
SINGLE POLE GUYING



POWER CIRCUIT less than 300 volts

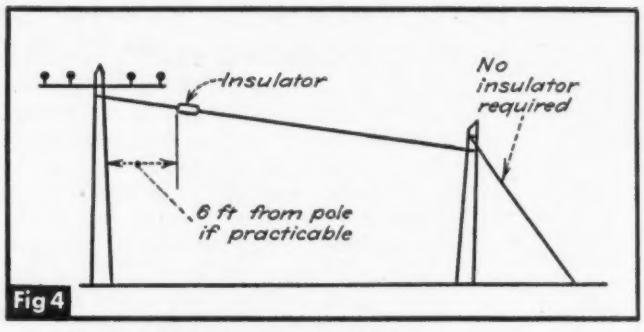


POWER CIRCUIT 300 to 15,000 volts

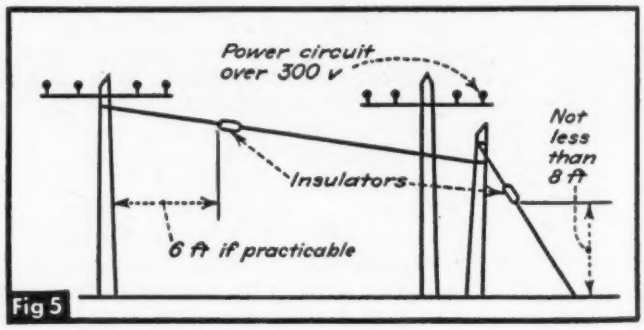


POWER CIRCUIT over 15,000 volts

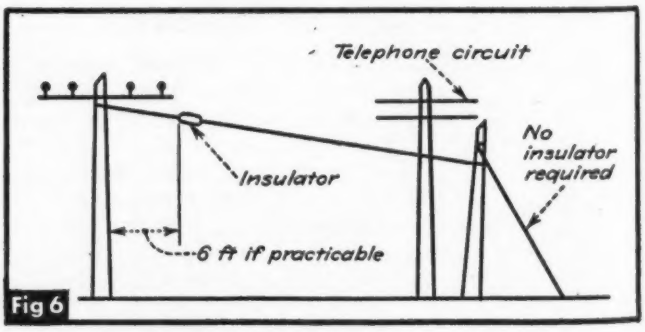
POLE AND STUB GUYING



POWER CIRCUIT 300 to 15,000 volts



POWER CIRCUIT 300 to 15,000 volts

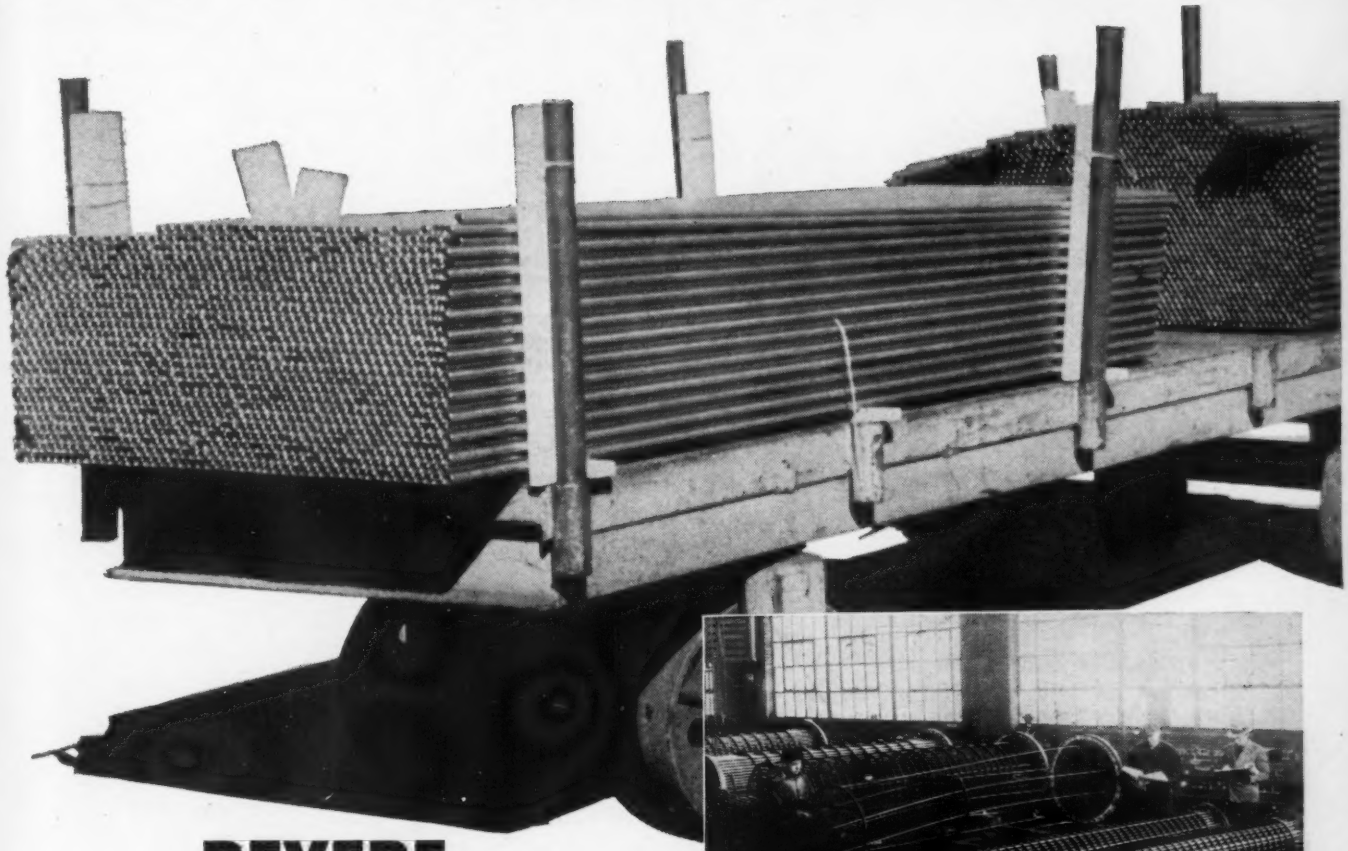


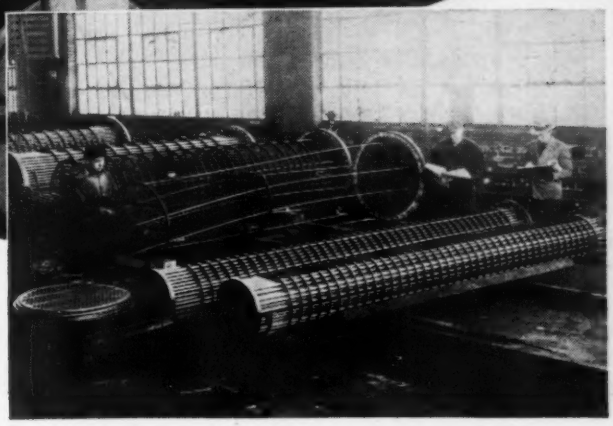
POWER CIRCUIT 300 to 15,000 volts

NOTES

In Fig 4, 5 and 6 on stub attach down guy above span guy in a manner to avoid contact between the two guys.

MEETING SPECIAL CONDITIONS





REVERE

REVALON and CUPRO-NICKEL

Because each condenser and heat exchanger presents its own special combination of conditions, no blanket recommendations for condenser tube alloys are possible. However, this much can be stated authoritatively: there are three Revere Metals which deserve special consideration in cases of limited or unsatisfactory tube life. Here they are:

Cupro-Nickel, 30%. Withstands high operating temperatures. A tenacious surface film forms on this metal, which resists impingement attack and erosion, salt water, and waters containing organic material. Widely used in marine and seaboard installations, the tropics and subtropics.

Cupro-Nickel, 20%. Similar to Cupro-Nickel, 30%, but lower in price and somewhat less resistant to certain types of corrosion.

Revalon (Aluminum Brass). This Revere Metal contains a small proportion of aluminum, which gives it a long life in applications where water velocities are high or water is saline. The film formed on this tube is tenacious and self-healing, rendering it highly resistant to impingement attack.

Which of these types to select, or which of the five other types of Revere Condenser Tubes should be chosen, depends on individual conditions. The Revere Technical Advisory Service will gladly collaborate with you in arriving at a decision as to the most economical tubes for your plant.

REVERE

COPPER AND BRASS INCORPORATED

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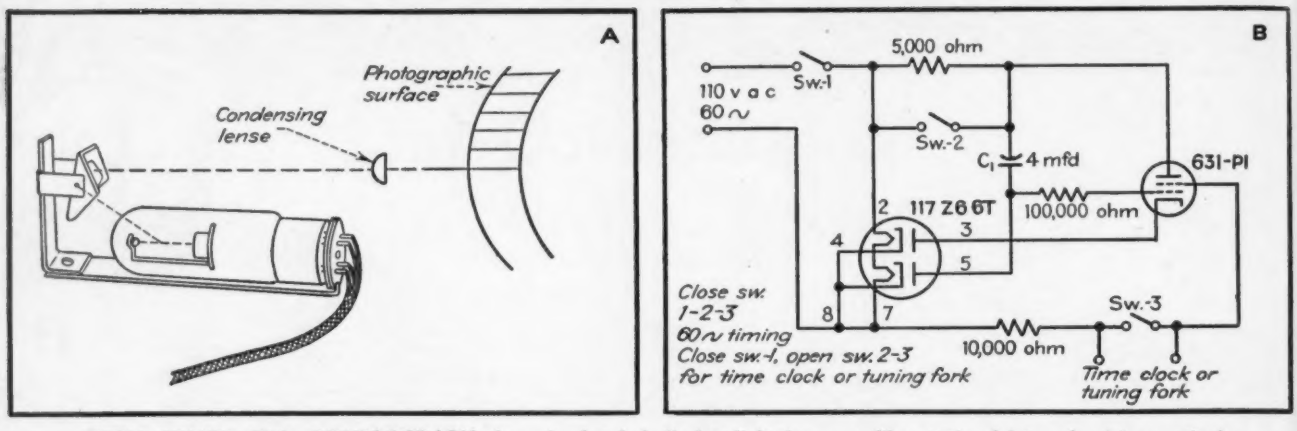
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N.Y.—Sales Offices in Principal Cities, Distributors Everywhere.

Neon Timer Releases Oscillograph Element



NEON TIMER FOR OSCILLOGRAPH shown in sketch A flashes light beam on film at timed intervals giving vertical timing lines across its width. Circuit diagram for timer is shown in sketch B above.

C. J. TIRK
Engineering Laboratories and Standards
Westinghouse Electric Corp
East Pittsburgh, Pa.

ON MOST OSCILLOGRAPHS a timing wave is obtained by connecting one of the oscillograph elements to the supply source. A relatively simple neon timer can be built to perform this timing function effectively. Thus one element of the oscillograph can be released to measure another circuit quantity. This is equivalent to adding an extra element to the oscillograph.

The neon timer circuit that we have used employs a 631-P-1 tube and a 177-Z-6 rectifier tube. As shown in the circuit diagram, the rectifier tube charges the condenser C_1 and the 631-P-1 tube discharges the condenser in the circuit.

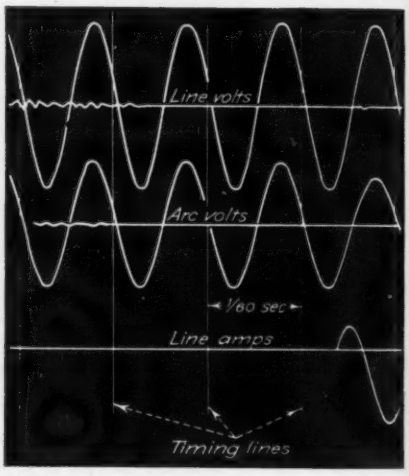
The time cycle is determined by the supply frequency. The discharge of condenser C_1 occurs once for each cycle of the supply frequency. Current is 300 amp and it lasts about 10 microseconds.

Timing in cycles, seconds or minutes can be obtained by using a time clock or low-frequency tuning fork in an alternate connection.

The neon tube is placed in the oscillograph near the elements and a small, thin mirror used to reflect and control the width of the light beam that is flashed on the film, giving a vertical line across the entire width of the film as shown in the sample oscillogram.

Once such a timer is installed and adjusted it will be satisfactory for both high and low-speed oscillograms.

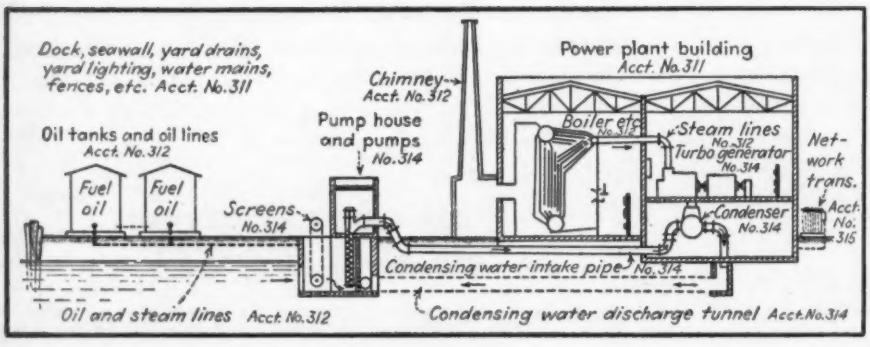
Timing lines on the film do not interfere with the record since they are of a different light intensity. The record of small peaks can be easily distinguished.



SAMPLE OSCILLOGRAPH illustrates vertical timing lines, made by neon timer

• • •

Numbered Diagrams Simplify Accounting Procedure


Dock, seawall, yard drains, yard lighting, water mains, fences, etc. Acct. No. 311
Chimney Acct. No. 312
Power plant building Acct. No. 311
Oil tanks and oil lines Acct. No. 312
Pump house and pumps No. 314
Boiler etc. No. 312
Steam lines No. 312
Turbo generator No. 314
Network trans.
Acct. No. 315
Fuel oil
Fuel oil
Screens No. 314
Condenser No. 314
Condensing water intake pipe No. 314
Oil and steam lines Acct. No. 312
Condensing water discharge tunnel Acct. No. 314

CROSS-SECTION OF STEAM PLANT showing identification of Federal Power Commission accounts for typical equipment

Equipment can be classified by means of Federal Power Commission account numbers when reporting capital, operating, and maintenance costs. These account numbers, shown in the diagrams, simplify the allocation of various labor and material charges.

The following is an example of how this numbering system works. A mason is hired to repair the power plant chimney. When the bill is received the accountant looks at the production print and finds that the

in Nine Years on Pennsylvania Water & Power Co.

In the interests of technical progress of high-voltage transmission, this series of operating reports is presented to the Electrical Industry. As a manufacturer of insulators and hardware, the Ohio Brass Company is vitally concerned in this development. These reports and many others will soon be compiled in book form and made available to power company engineers.

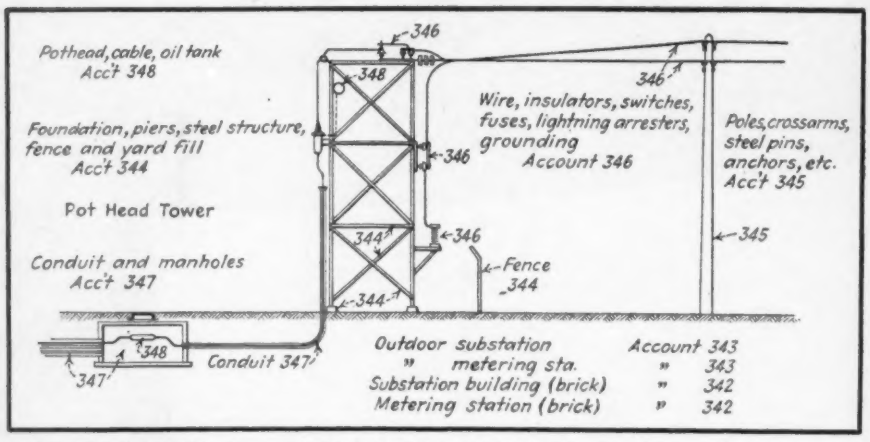
2849-H

Ohio Brass

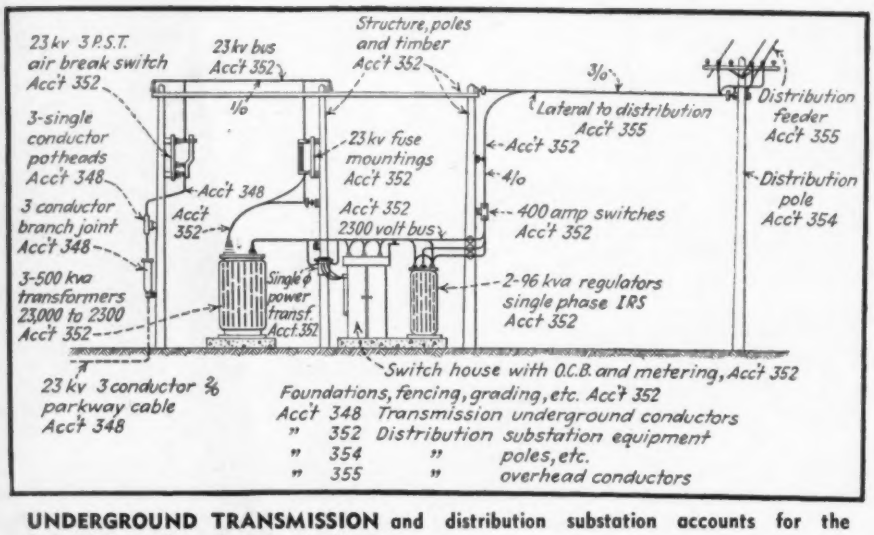
MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

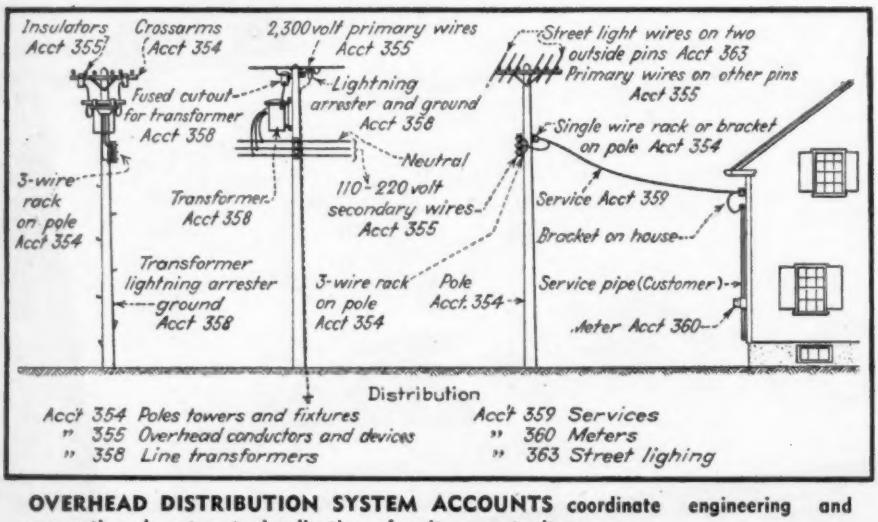
chimney is in Account 312 since the Commission rules that the stack is an integral part of the boiler. Account 312 is a capital account, and chimney repairing is a maintenance function. Thus, the account pertaining to boilers is reviewed and a correct voucher prepared. This enables the accounting department to visualize equipment relation to other components.



IDENTIFICATION OF TRANSMISSION ACCOUNTS simplifies allocation of costs in construction, operation, and maintenance.

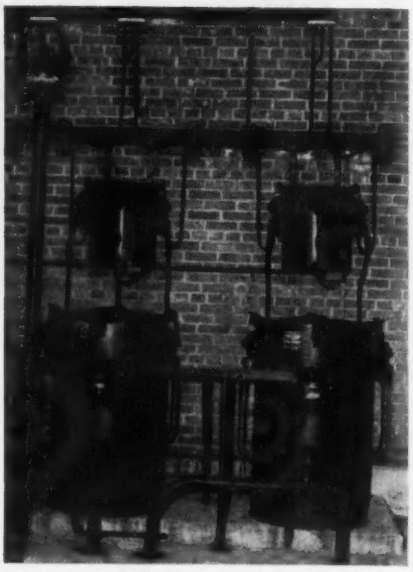


UNDERGROUND TRANSMISSION and distribution substation accounts for the Federal Power Commission's classification



OVERHEAD DISTRIBUTION SYSTEM ACCOUNTS coordinate engineering and accounting department visualization of unit property items

Centralize Industrial Yard Lighting Service



ARRANGEMENT for lighting yard from switchboard. Instrumentation is indoors and minimum wiring cost results

AN EASTERN PLANT in a suburban location required high-grade yard lighting during the war. Space was readily available for constant-current transformers in accessible settings. Three typical 15-kw units were placed on a concrete mat in a locked inclosure. A 2.4-kv, 3-phase feeder from a main substation was brought underground to a riser pipe terminating in a pothead and tapped into a 2.5-in. horizontal conduit run at the top of the assembly. Leads from this pipe were dropped vertically to 50-amp cutouts attached to a channel-iron below. This channel also supported three remotely-controlled oil circuit breakers (governed from an inside switchboard). From these breakers, short connections led to the c.c. transformer terminals. Three 20-amp series circuits were run from the transformers to the extensive yard area.

This layout enables any yard section to be lighted from the switchboard as desired. All instrumentation was indoors, and the use of rigid conduit gave excellent protection to the maintenance forces. The unified arrangement made quick installation feasible. Minimum wiring cost is an advantage that resulted from this design.

Fashions CHANGE...

in circuit protection, too!

Time was when the lady of the house would plot a dark and perilous course to the cobwebby cellar . . . explore its electrical intricacies . . . cross her fingers—and hope for the best.

Today . . . when current fails . . . she knows just where to look! She goes straight to the *accessible* Federal NOARK multi-breaker . . . flicks a convenient switch . . . and, presto! . . . the world lights up again!

Simple, reliable, good-looking Federal NOARK multi-breakers are available in a complete range of ampere ratings — for both indoor and outdoor applications.

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Maintain
CONTINUITY of SERVICE
with
"Autocall" supervision

"High Bearing Temperature" . . . "Bleed Steam Temperature Too High" . . . "K. W. Load High Limit" . . . these are typical facts that power plant personnel **must** know if continuity of service is to be maintained!

Obviously, continuous human inspection to provide such information is not practical. With Autocall supervision, however, responsible personnel are **automatically** warned of changes in pressure or temperature, variation in the levels of fluids, and the occurrence, continuance, or termination of any mechanical movement.

Annunciators such as the Type ANF-8 shown above flash the alarm, while, if desired, a log record is automatically printed in plain English by the Vertical Supervisor — a compact and complete Supervisory System in itself — shown at left.

It will pay you to investigate Autocall supervision. For full details send for the free booklet shown below. There is no obligation.

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REG. U. S. PAT. OFFICE
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SHELBY, OHIO

Damping Combination Stops Span Vibration

E. M. WRIGHT
Pacific Gas and Electric Co
San Francisco, Calif.

SERIOUS VIBRATION of unusually high magnitude and frequency on three long river-crossing spans of the Pacific Gas and Electric Co has been remedied after extensive field investigation. A combination of long armor rods, auxiliary cables and Stockbridge dampers were found satisfactory for damping such severe conditions of conductor vibration. Careful tests taken after the final installation showed no appreciable vibration.

Severe vibration on these spans of 4135, 3175, and 2250 ft was due to unusually high steady wind velocity attributable to the surrounding topography. The crossings are near the junction of the Sacramento and San Joaquin rivers where they flow through a narrow gap some 20 miles before emptying into the northern end of San Francisco Bay. But at this location winds reached steady velocities of 32 mph at the top of the towers and set up vibrations of 80 or 90 cycles per second and ¼-in. amplitude in the 795,000-cm ACSR conductors.

Armor rod was first tried, extending 5 ft on each side of the two string yoke suspension. Over a period of 4 months various combinations of Stockbridge dampers ranging from 6 to 14 lb, four to thirteen in number and spaced as far out as practical on the conductor were tried in conjunction with the armor rod without success. Vibration was still so severe that strands broke in the conductor at damper supports close to the tower, and at times the high strength steel in the dampers failed within an hour after installation.

As a result of these trials which showed conclusively the need for something more than the conventional installation of dampers, a successful design was worked out in collaboration with the Aluminum Co. of America. Gradual increase of mass along the conductor was applied. Sets of ten ½-in. aluminum armor rods were 36 ft into the long span on one side of the tower and 6 ft. into the

IT TAKES A
good man
TO DO A
good job-

...AND A good tape COMPLETES THE JOB!

One sure way to get a good tape, all the time, is to make certain every roll you buy is ACCURATE TAPE. Then, whether it's friction or rubber, you know that every foot more than complies with the requirements of A.S.T.M. (American Society of Testing Materials), and all power company specifications. Full, guaranteed footage in every roll. Shipments of ACCURATE TAPES can be made promptly from stock, and in quantity. Accurate Manufacturing Company, Main Offices and Plant: Garfield, New Jersey.

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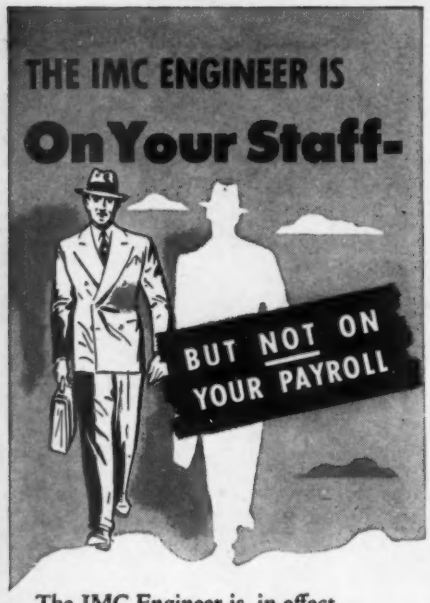

The IMC Engineer is, in effect, traveling companion to IMC products. He provides "experience at work" to insure insulation that approaches perfection. He's always ready to . . .

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2. Familiarize you with the proper application.
3. Suggest ways to eliminate waste.
4. Help increase your production.

Complete insulation service from one source.

Full line of nationally recognized products.

Fabricating facilities to supply your needs.

"Know-how" engineers...strategically located.

Prompt shipment from complete stocks.

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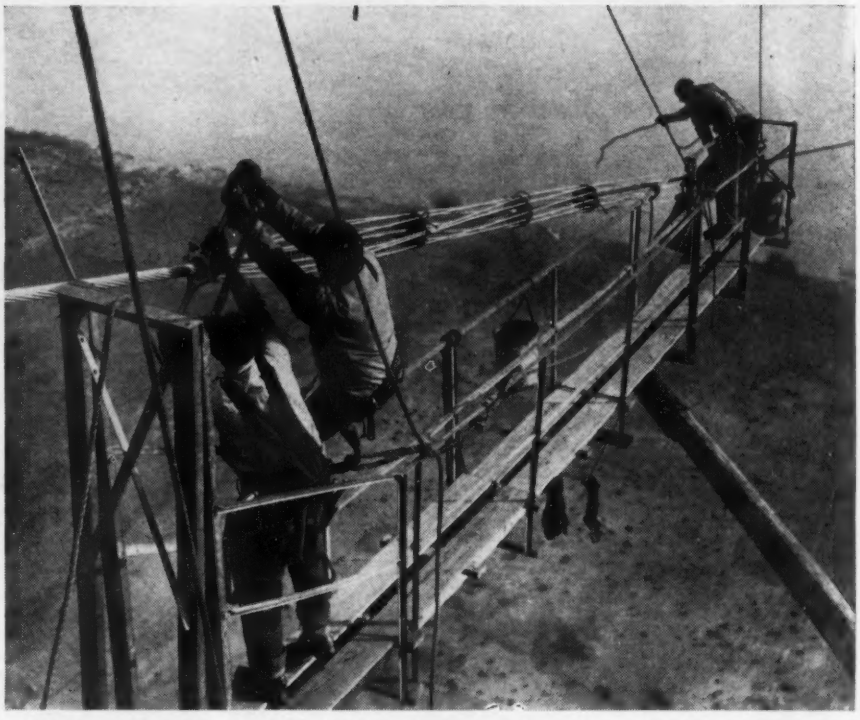
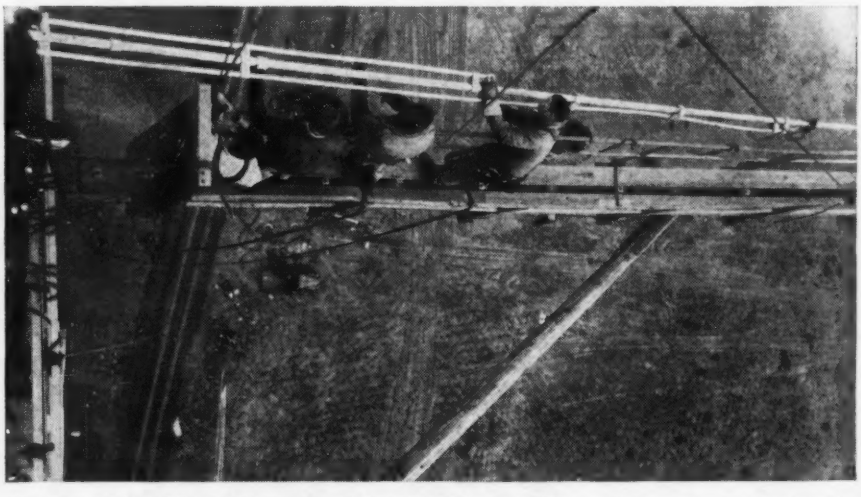
- CLEVELAND 14, 1231 Superior Ave., N. E.

MILWAUKEE 2, 312 East Wisconsin Ave.
DAYTON 2, 1315 Mutual Home Building
DETROIT 2, 11341 Woodward Ave.

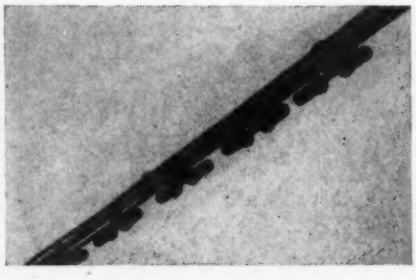
REPRESENTATIVES in MINNEAPOLIS 3, 1208 Harmon Pl., and PEORIA 5, 101 Heinz Court.



ARMOR ROD BEING INSTALLED as part of damping combination to remedy severe vibration on three river-crossing spans of Pacific Gas and Electric Co. Ten ½-in. aluminum rods are used extending 36 ft into the long span, 6 ft into the short span



TWO PARALLEL LENGTHS of the 795,000-cm ACSR conductor are next installed to contribute to increasing mass along the conductor approaching the support

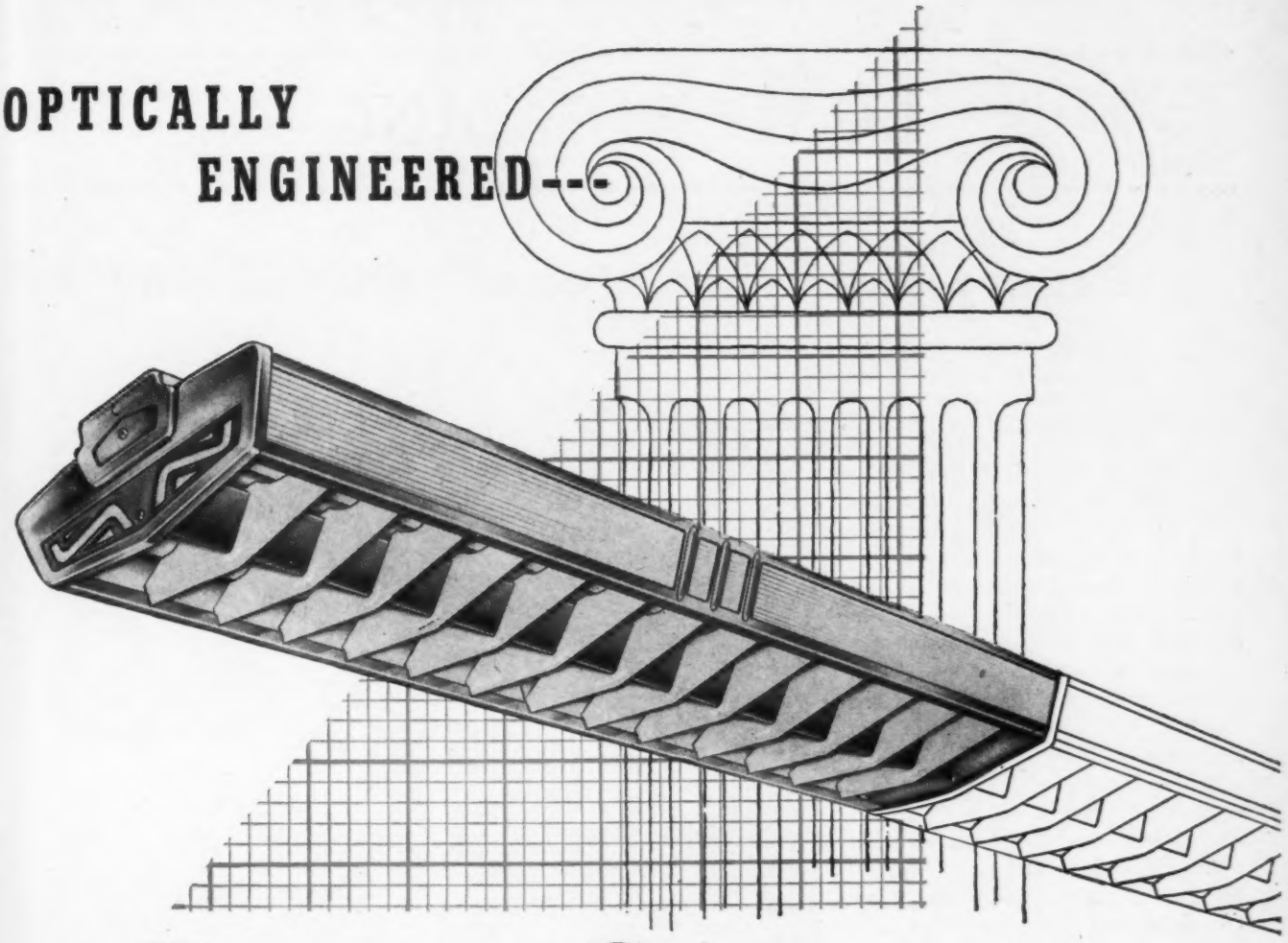


STOCKBRIDGE DAMPERS of most effective weight and spacing complete the installation. Tests taken during two years of trouble free service of final installation have shown no appreciable vibration

short span on the other side. The rods were used in combination with parallel cables and most effective weights and spacing of dampers determined from the previous tests. Although it was necessary to hang sacks of sand on the conductor during the installation because of severe undamped vibrations, tests after completion showed no appreciable amplitude of vibration on the conductor.

Two years of trouble free operation have justified installation of this type of protection against vibration on similar spans since completed.

OPTICALLY ENGINEERED--



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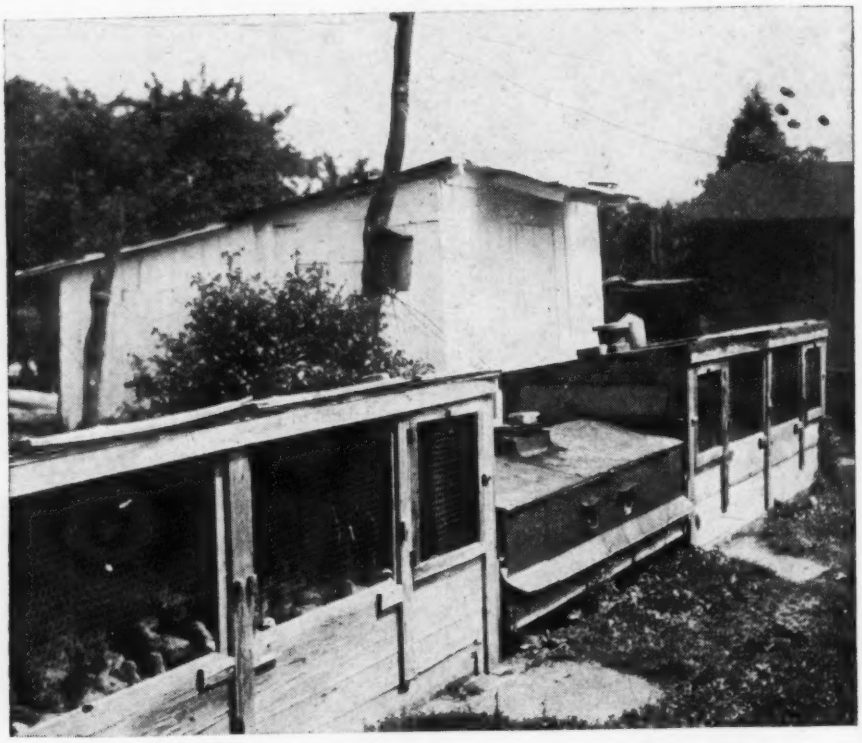
Lighting

LOAD BUILDING

Electric Brooders Pay for Home Electric Equipment

J. W. HALL
Agricultural Engineer
Appalachian Electric Power Co
Roanoke, Va.



FROM THIS ELECTRIC BROODER (center structure) and another installed a year later, there developed a business that sells 100 or more broilers per week and that paid for farm home electrification

NO SITTING with folded hands in a rocking chair for Mrs. A. K. Kessler. At her age of 66 years, she might have figured she was entitled to take it easy for the rest of her days. But she had been up and doing all her life and she was not going to stop now. On the advice of her son, she decided to raise a few broilers, just to have something to keep her occupied.

A coal-heated brooder was first considered. But that idea was discarded when we showed how much more convenient and easier to operate an electric brooder would be. On plans we supplied, her son built for Mrs. Kessler a 400-chick outdoor brooder equipped with a 1,000-w fan-type brooder unit and with runways at each end. Every 6 weeks, 400 day-old chicks were started in the brooder. That was in 1942. So successful was this brooder that another just like it was added the next year, doubling the broiler production.

When Mrs. Kessler started her business, the broilers were dressed on the farm and sold on the Roanoke curb market. But for the past 4 years, practically the entire output has gone to the Hotel Roanoke on a standing order for 100 or more per week and the chickens are prepared for use at a local dressing plant.

During the years before the electric brooders were installed, the average annual use of electricity by Mrs. Kessler was 1,401 kwhr. In 1946, it was 7,646 kwhr. Not all of the increase was due to the brooders. Some of it results from the use of an electric range and other electric home equipment that was paid for from profits earned by the brooders.

• • •

Heat Pump Operation Data

IF YOU DON'T LIVE too far north of the Mason and Dixon line, you can keep your house warm in winter and cool in summer with a heat pump at pretty reasonable cost. This was shown by the heat pump operating record for a residence in Chattanooga, Tenn, presented at a recent meeting of the Southeastern Electric Exchange by Marvin Smith, of the Muncie Gear Works, makers of the

Heating Season 1946-1947

	October and November	December	January	February	March	April	Total
Degree Days—65° Base	456	626	652	826	684	109	3,353
Degree Days—77° Base	1,188	998	1,024	1,162	1,056	469	5,897
Btu Heat Requirement (Millions per month)	26.85	22.6	23.2	26.3	23.9	10.6	133.45
Kwhr Equivalent	7,870	6,630	6,800	7,700	7,000	3,150	39,150
Metered Kwhr	1,570 (Estimated)	1,408	1,781	2,095	1,861	606	9,321
Performance Coefficient	5 (Assumed)	4.7	3.8	3.7	3.75	5.2	4.36
Energy Cost	$9.40 (Estimated)	$8.45	$10.68	$10.57	$11.17	$2.42	$52.69

Cooling Season 1947

	May	June	July	August	September	Total
Metered Kwhr	529	518	694	1,324	8.14	3,879
Energy Cost	$2.12	$2.08	$2.78	$7.30	$3.26	$17.54

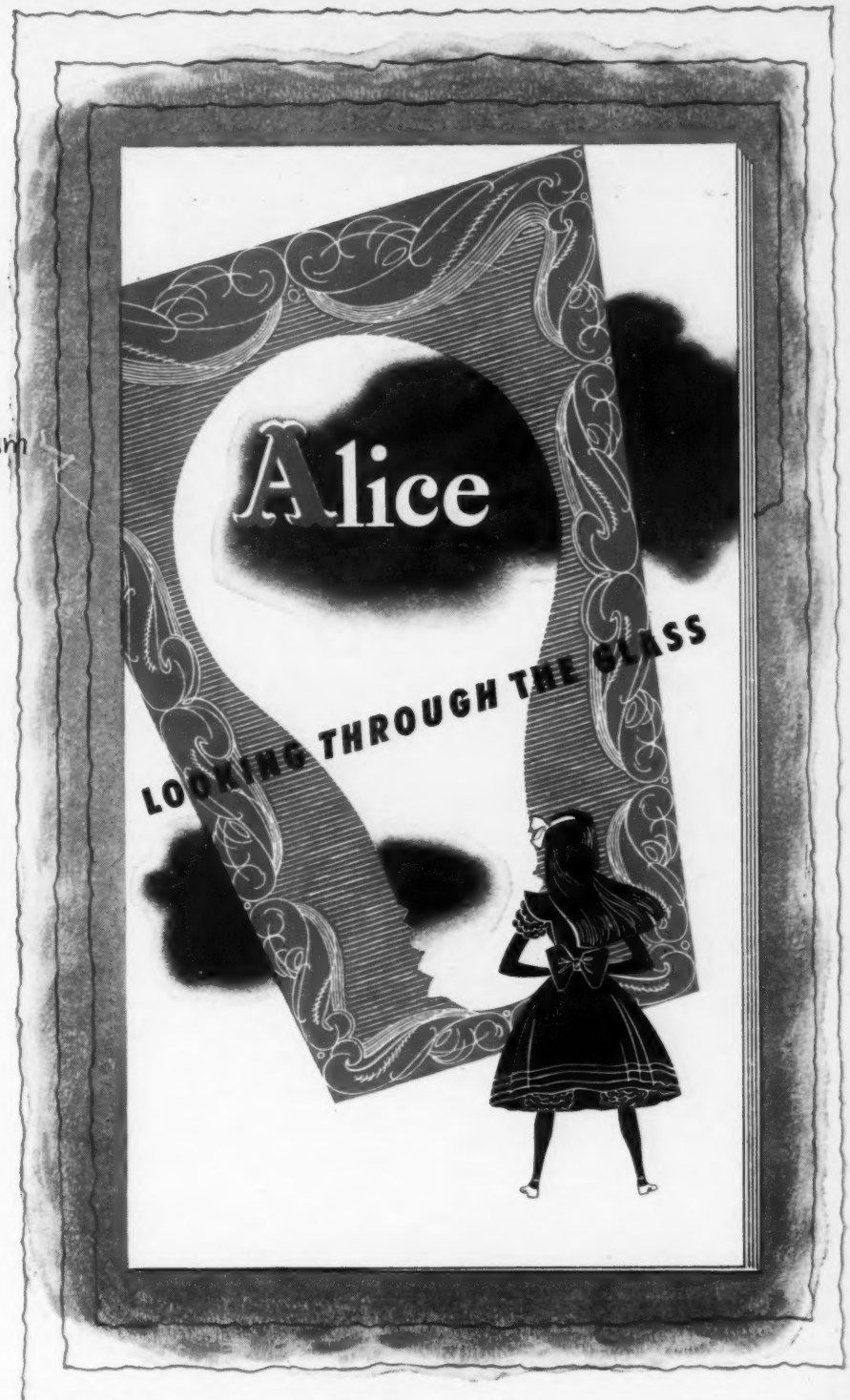
Another G-E Lamp

Planned Lighting Tool

for your home education program

Here it is—actual size—a brand new General Electric 20-page booklet to help you "educate" your residential customers on the correct use of lamp bulbs. Now off-peak home lighting load is more desirable than ever. And this booklet tells quickly and entertainingly the right way to use *right-size* G-E household lamps of every type.

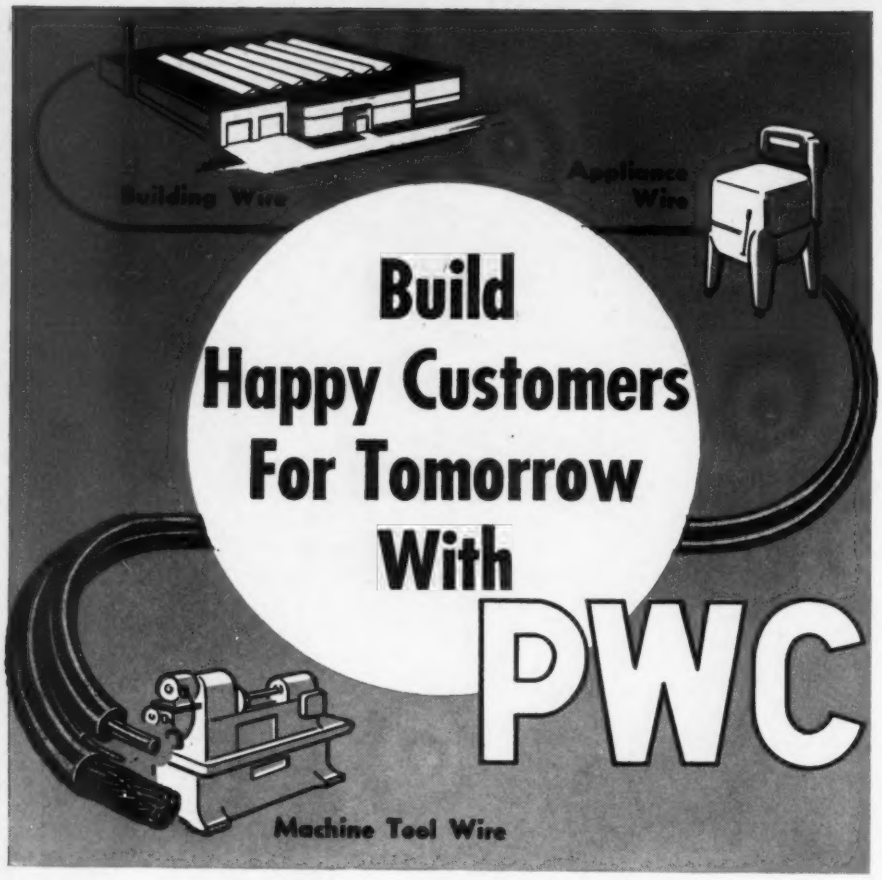
"Alice Looking Through the Glass" should be distributed to every home on your lines. Mail it with statements. Hand it out at your cashier windows. Or, if you sell G-E lamps, give it away at the counter. You can get all you want through your nearby G-E Lamp office at only 2½¢ a copy.



Public demand for G-E bulbs is the highest in history—and *now* there are plenty for everybody—25, 40, 60, 75, 100 and 150 watts. So there's no excuse for bulbsnatching! Why not put "Alice" to work in your Spring home lighting program, and fill empty sockets with right-size G-E bulbs—the lamps that are constantly improved by research to *Stay Brighter Longer!*

GENERAL ELECTRIC LAMPS

STAY BRIGHTER LONGER



Whether you're wiring factories, office buildings, machine tools or major or small appliances, the finished job will be better because you have used PWC wires.

For PWC building wires, machine tool and appliance wires (UL approved to 80° C) have insulations that are super-aging, virtually immune to oxidation; that won't support combustion, thus eliminating the fire hazard of ordinary insulation. They're highly moisture resistant, not affected by vegetable, mineral or lubricating oils and greases, and there's no discoloration or corrosion of copper conductors.

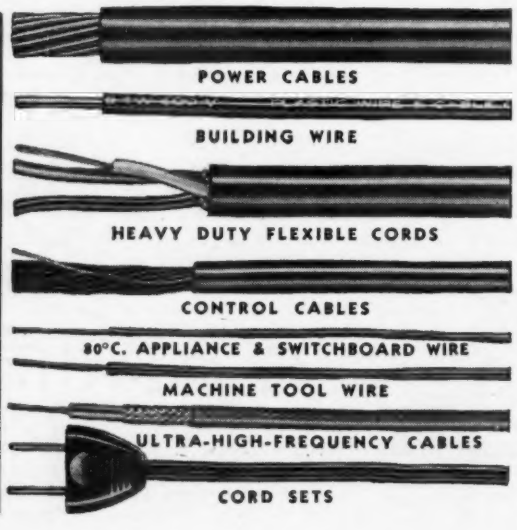
Other PWC properties speed work to save labor costs . . . for instance: ease of stripping, pulling through conduits and color coding (up to eight standard colors, others on special order). And smaller diameters permit more wires in a given conduit or space.

Write us your requirements so that we can talk PWC performance on these or other wires or cables in terms of your specific needs.

PWC

PLASTIC WIRE & CABLE CORP.

407 East Main St.
Jewett City
Connecticut



well-known "Marvair" heat pump.

The data covered heating in the colder months of 1946-1947 and cooling in the summer of 1947. The average coefficient of performance (COP) of the heat pump for the 7 months when heating was required, was 4.36. Temperature maintained in the house was 77 F. Degree days per month on this temperature base, times the calculated heat loss per degree temperature difference, gave the monthly heat requirement. [Degree days (77 deg base) x 943 BTU per hr (heat loss per degree TD) x 24 hours] The cost of electricity for heating was $52.69 and for cooling $17.54, making the total for the 12 months $70.23. The heat source was well water.

•

"Telequizzicals" Promote Television

ROBERT LATIMER
St. Louis, Mo.

TELEVISION HAS NOW COME into the load-building operations of Union Electric Co of Missouri. The utility is sponsoring a "visual quiz program" in cooperation with leading St. Louis appliance retailers.

Under the plan, owners of home television sets and appliance dealers' visitors compete for appliances and other prizes. The program, a half hour broadcast each Monday night, is built on participation by the television audience. Entrants are drawn from some 700 video owners in St. Louis, plus selected groups of prospects invited to appliance stores. This latter provision, whereby appliance retailers may select a customer as a contest entrant, has been eagerly seized upon by many retailers. Any store operating television sets may tune in, of course, but only two stores can provide contest entrants for any one broadcast because only four or five reply telephone calls can be made per evening.

The "contest" consists of charades performed on the video screen by Harry Gibbs, Union Electric radio star, who is also master of ceremonies. Before the show, Mr. Gibbs selects a list of television set owners from the master list and telephones them to inform them that of their se-

Portahs ain't acrobats!

Use the New Guth FLOATING HINGE ARISTOLITES

The Luminaire that Makes the Dusting Ladder Obsolete!

A simple gripper tool on a pole unseats the glass panels. A handy mop at the opposite end of the same pole does the dusting job.

With the revolutionary new GUTH Floating Hinge Aristolite*, the entire dusting operation can be done regularly, easily, safely, *right from the floor!*

The dangers of cleaning are gone! The bother and bustle of cleaning are gone! Fixtures get dusted *regularly* when you have GUTH Floating Hinge Aristolites, because it's no trouble to do it. You get more light, better light, more consistent light, from luminaires that get cleaned regularly.

To clean these amazing fixtures, the glass panels are safely and easily swung open and hang securely on the floating hinge. Then follows a quick dusting—and back go the glass panels! So simple—so safe!

Write today for Bulletin No. **812-B** which gives full details about this revolutionary new fixture.

FOR THE BEST IN LIGHTING FIRST GET A PLAN FROM THE MAN WHO PLANS

*Trade Mark Reg.
Pats. Pending

Distributors Conveniently Located from Coast to Coast

Leaders in Lighting Since 1902

Guth

THE EDWIN F. GUTH CO.

2615 WASHINGTON AVE. • ST. LOUIS 3

a Program You'll Find Profitable to "CHAMPION" in Your Plant

You can take that two ways — both of them good business for you.

1. *Planned Lighting* is a cause worth *championing* from every standpoint — quality and quantity of output, worker morale, accident reduction, long-run economy.

2. CHAMPION Fluorescent and *Incandescent* Lamps for your planned lighting program give you efficient, dependable industrial lighting. CHAMPION manufacturing, testing and control methods assure lamp quality that is second to none. CHAMPION's policy of low overhead and clean-cut distribution through selected industrial distributors assure minimum lamp and lighting costs.

DEDICATED TO PLANNED LIGHTING

This modern plant and everyone in it is working night and day to implement your planned lighting program with the finest lamps that can be produced by modern equipment backed by forty-eight years of experience.

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

lection. Two appliance retailers who must be franchise television retailers are also chosen, each allowed to enter one contestant.

Contestants, vying simultaneously while three subjects are pantomimed on the screen, telephone in their guesses. While this is being done, the video camera shows the entrants the prizes they will win for guessing respectively one, two or all three of the subjects correctly. It requires skillful handling to receive all guesses and credit them correctly; this is done by means of passwords between the KSD television studio and the entrants.

Those who guess one act correctly receive irons, toasters, coffee makers, lamps, etc; two wins qualify the entrant for midget washing machines, radios, etc; and three-way winners get electric blankets, sun lamps, ironers, etc.

The programs have been particularly valuable to the promotion of television because retailers can win a lot of unusual goodwill and interest through inviting prospects in for the Monday night show, according to Walter G. Heren, advertising manager. By rotating the list, every television owner will eventually have his opportunity to compete for prizes, at the rate of four or five given away each Monday night.

•

Conference Sells School Lighting

C. D. HOLLISTER
Lighting Advisor
New York Power & Light Corp
Albany

IN EASTERN NEW YORK STATE 83 school buildings are under cosideration for erection or remodeling or addition. Of these, cost estimates have been completed on 57 buildings, indicating a construction cost of $19,488,000. In this same area there are, in addition, 522 present school buildings, many of which are inadequately lighted.

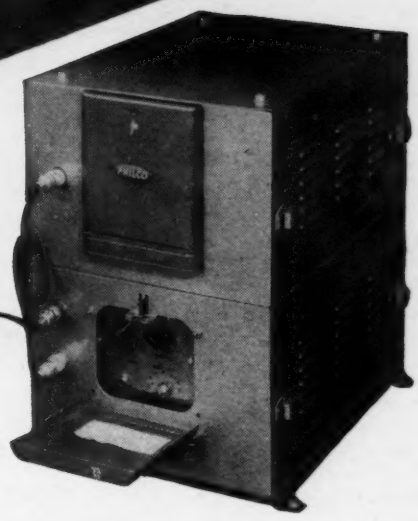
The proper lighting of these buildings is naturally of immediate concern to the school architect. It is the function of the utility lighting department to furnish the architect with up-to-date lighting information. In addition to the architects, how-

New, Sensational FM Radiophone COMMUNICATIONS SYSTEMS

by PHILCO

the Leader

"MICRO-SELECTIVITY"



ONLY PHILCO HAS IT!

The amazing PHILCO FM "Channel Saver" Circuit operates within a band width of only 20 Kilocycles. Its "micro-selectivity"—better than 85 db. down at 40 Kc from center frequency—permits adjacent channel operation on the basis of present frequency allocations. This allows higher standards of efficiency in only half the channel width without loss in voice quality, protects you against equipment obsolescence. Only PHILCO Has It . . . Plus . . . many new developments in equipment design. Mail the coupon, today, for full details.

- Philco Radiophone Systems are Available for Operation on All Frequencies Assigned for Mobile Communications.
- Free Engineering Consultation Service.
- Nationwide Service Organization.

PHILCO

INDUSTRIAL DIVISION

PHILADELPHIA • PENNSYLVANIA

Dept. K-5, Industrial Division
Philco Corporation
C and Tioga Streets
Philadelphia 34, Penna.

Gentlemen:

Please send me information about the new PHILCO FM Radiophone Communication System.

NAME_____

ADDRESS_____

CITY_____

NORTH • EAST • SOUTH • WEST • IT'S SCHRAMM

The Air Compressor You Like to Operate

compact . . . no waste space, compressor and engine coupled into a single, rigid, permanently aligned unit . . . balanced to reduce wear and increase efficiency!

lightweight . . . Portables designed for quick handling to and from the job, stationary units vibrationless.

easy to start . . . Just push the built-in electric starter, and the Compressor starts . . . to give you a continuous amount of air.

TOOLS FOR THE JOB

Schramm Inc. also has a complete line of Pneumatic Tools to offer and recommend for operation by their Compressors.

These include Rock Drills, Paving Breakers, Trench Diggers, Clay Spades, Backfill Tampers, Tie Tampers, Sheeting Drivers, Demolition Tools, Chain and Circular Saws.

Write for bulletins and prices.

. . . For these reasons users of Schramm Air Compressors have said they *like* to operate both stationary and portable Schramm units.

Other features, however, enter into the usefulness of Schramm. There's 100% water cooled feature, allowing you to operate Schramm perfectly both summer and winter; mechanical intake valve, forced feed lubrication, to mention a few.

Schramm features make them the Air Compressors ideal for your many jobs . . . and the reasons they're specified North, East, South and West. Write today for data.

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

ever, the 43 school superintendents, 306 school principals and 280 school boards of the area, were each personally concerned that the money spent for lighting in their school buildings should return the best value possible. A conference on school lighting was felt to be the only feasible way to bring authoritative information to this large number of individuals.

A tentative program was first discussed with school superintendents, executive members of the State Principals Association and State School Association, as well as the State Department of Education.

Conference Planning

Meeting arrangements included the following:

1. The Schenectady School System relighted and repainted two classrooms adjacent to the meeting auditorium.

2. Large charts of measured daylight, of replaced artificial lighting, and of new lighting intensities were hung in each classroom to indicate the improvements attained.

3. Photo-offset reproductions of the lighting and painting layouts were prepared for handouts.

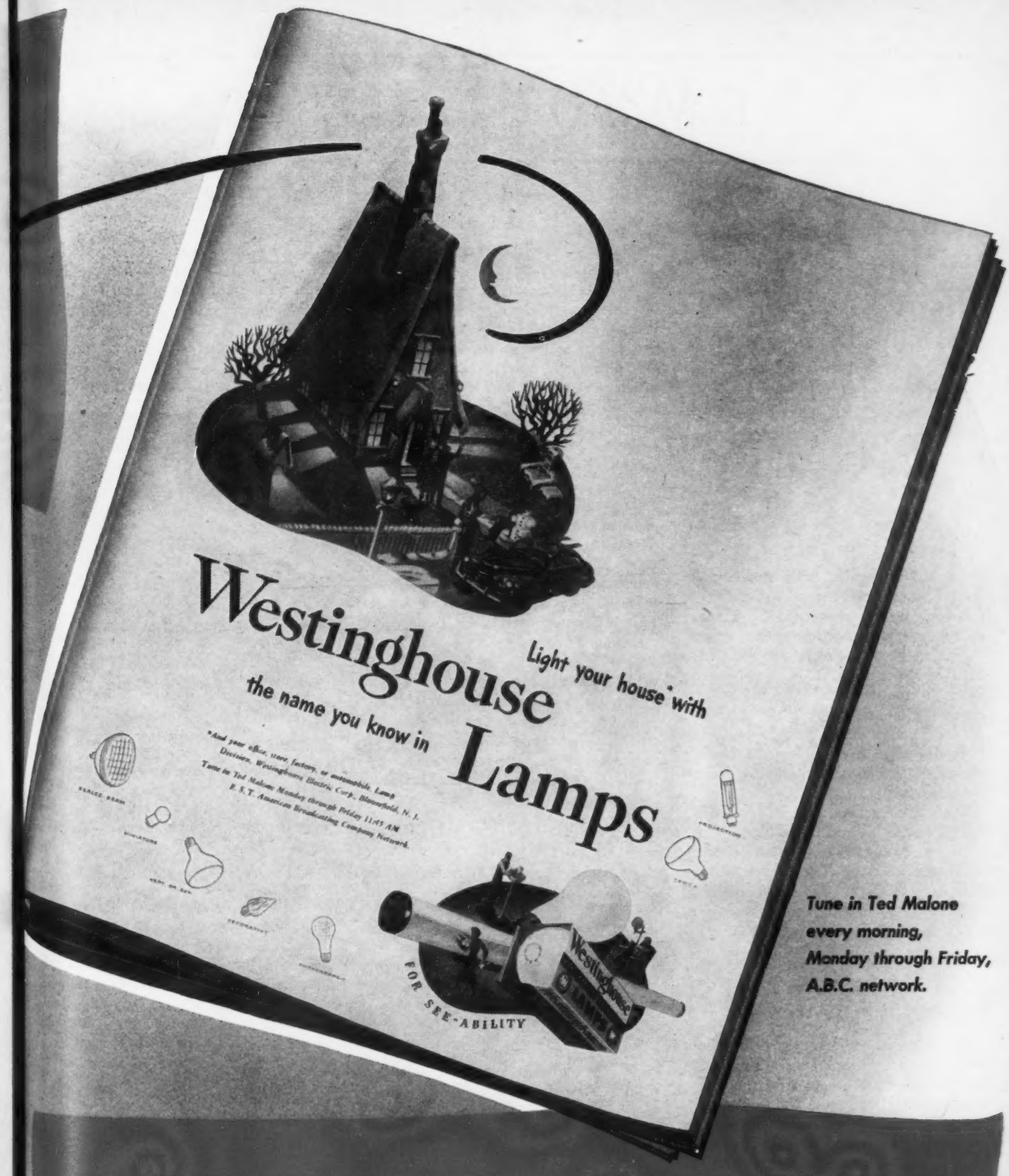
4. A PA system was installed in each room so that questions could be answered.

5. Committees were appointed to handle tickets, stage props, car parking, checking and emergencies. A "dress" rehearsal was held the day before the meeting.

6. Invitations, with return-reply cards addressed to the Schenectady Superintendent of Schools, were mailed.

7. All school superintendents and many principals and school board chairman were contacted personally.

250 educators attended the meeting, which was held on a regular school day from 9.30 A. M. to 3.30 P.M. School was closed at 12:00 noon so that the cafeteria facilities would be available for lunch and so the relighted classrooms could be inspected by those attending. The fact that the meeting was prolonged until after 4:00 P.M. because of open forum discussion and questions gives some indication of the interest shown. Since the meeting, many letters of appreciation have been received and several inquiries for specific added information have been made.


Westinghouse
Light your house with
the name you know in
Lamps
*And your office, store, factory, or automobile. Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J.
Tune in Ted Malone Monday through Friday 11:45 AM E.S.T. American Broadcasting Company Network.
FOR SEE-ABILITY

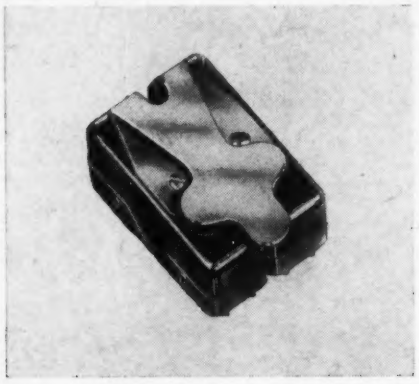
Tune in Ted Malone every morning, Monday through Friday, A.B.C. network.

Westinghouse *Lamps*

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

NEW EQUIPMENT

Precision Switch



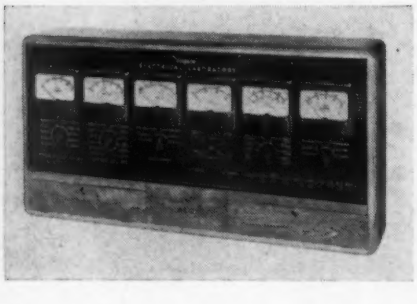
CIRCUIT CONTROL with double-pole, double- or single-throw switching is provided by the new type SA-1 snap-action precision switch manufactured by Unimax Switch Corp, 460 West 34th St, New York 1, N. Y. Comprising an assembly of two standard Unimax precision switches, ganged for mounting on 1-in. centers, the type SA-1 switch is equipped with a duplex Adaptaplate which actuates both switching elements simultaneously.

Body dimensions of the type SA-1 switch are: 1 15/16 in. long 1⅜ in. wide, and 15/16 in. high including Adaptaplate; overall length, including Adaptaplate, is 2⅛ in. This new dpdt unit carries rationings of 15 amp at 125 v and 5 amp at 250 v a-c.

•

Combination Instrument

ANNOUNCED FOR DELIVERY by Simpson Electric Co, Chicago, Ill. is its new model 1005 Electrical Laboratory, a new multiple purpose test instrument. It is designated by the makers as a complete test unit for use by electronic and electrical technicians in laboratories, shops or service departments. The device is said to combine the functions of over 60 separate instruments. It consists of six individual 4½-in. rectangular instruments, each with a complete set of ranges.



In addition to the variety of a-c and d-c voltage and current ranges, a multirange ohmmeter and a single-phase wattmeter have been incorporated. Also, to meet the need for extreme sensitivity required in testing circuits where only a small amount of current is available, an instrument is provided with a sensitivity of 50 microamperes, providing 20,000 ohms per volt on all d-c voltage ranges. The unit incorporates a rectifier type instrument for measuring a-c voltage with a resistance of 1,000 ohms per volt on all ranges. This latter instrument also has in combination a complete coverage of db ranges from minus 10 to plus 55 for volume indications.

All instruments are indirectly illuminated. The panel is anodized aluminum. Cabinet is natural finish birch. All connections are made to binding posts located on the panel. Test leads and break-in plug are furnished. Size is approximately 34 in. x 17 in. x 9 in.; weight 37 lb.

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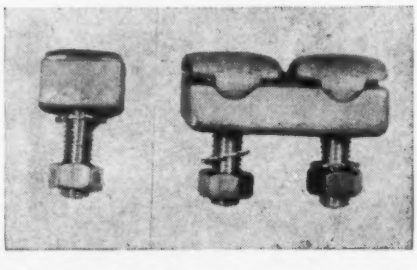
Power Connectors



NEW LINE of multi-purpose cable connectors, known as "bathtub" types because of their shape, has beeen introduced by Royal Electric Mfg Co, 1122 East 87th St, Chicago 19, Ill. Designed for connecting cable to a flat surface, they can be used with circuit breakers, disconnect switches, fuses, transformers, and for ground connections. They are reported to be especially adaptable to taping because of their smooth rounded form.

The connectors are made in two styles. for either one or two cable connections, and in sizes to handle from No. 6 solid conductor to 1000 M cir mil cable. The clamp body is bronze alloy.

•

Variac Autotransformer

LATEST ITEM in the line of Variacs produced by General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass., is the type V-20. This unit is reported to deliver more kva per pound than older models. The type V-20M is rated 3.45 kva, 115 v, and type 20-HM is rated 2.3 kva, 230 v. Output voltage is continuously adjustable from zero to 17% above input line voltage.

Terminal box is designed for use with BX or conduit. Exposed surfaces are said to be corrosion resistant. Overall dimensions are 7⅞x9⅝x5½ in., and net weight is 22¾ lb.

•

Water Conditioner

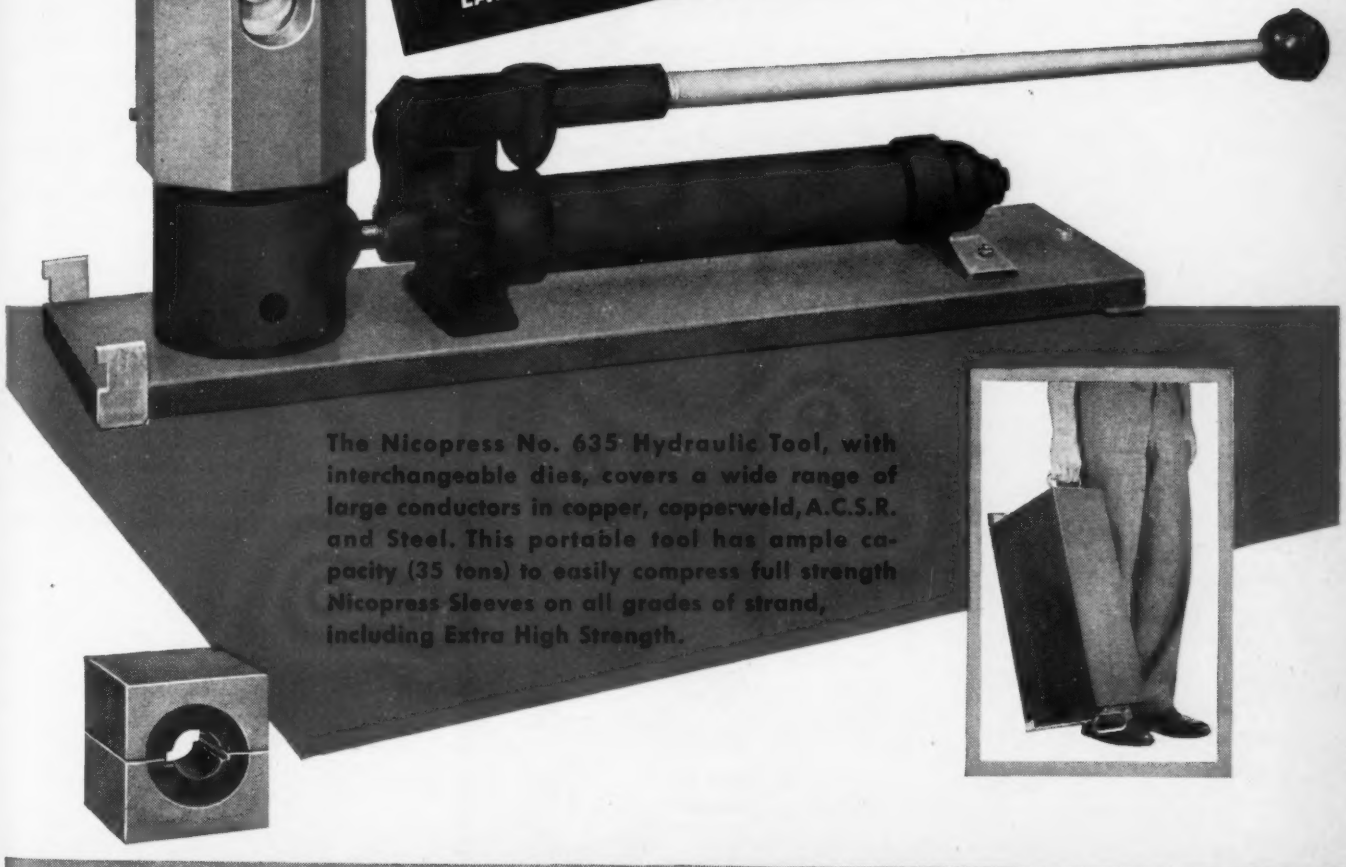
BASIC ELEMENTS of equipment for mixing, floc formation, settling, and thickening are combined in a single reaction vessel, the Cochrane Rapid Reactor. The vessel was recently developed by Cochrane Corporation, 17th St and Allegheny Ave, Philadelphia 32, Pa. Its application is the conditioning of process-cooling water and boiler feed. Chemical reagents may be introduced for coagulation of turbidity

SLEEVES for LARGE CONDUCTOR & STATIC WIRE SPLICING

Nicopress No. 635

HYDRAULIC TOOL

FOR INSTALLATION OF NICOPRESS SLEEVES ON LARGE CONDUCTORS AND HIGH-STRENGTH STRANDS



The Nicopress No. 635 Hydraulic Tool, with interchangeable dies, covers a wide range of large conductors in copper, copperweld, A.C.S.R. and Steel. This portable tool has ample capacity (35 tons) to easily compress full strength Nicopress Sleeves on all grades of strand, including Extra High Strength.

Telephone Supply Company

CLEVELAND 3, OHIO

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

LOOK TO LOCKE...FOR Convenient Stocks OF DISTRIBUTION MATERIALS

A Complete Line

of distribution materials—pole line hardware and insulators—is maintained at each of many different points throughout the country in Locke's regional stocks and in distributors' warehouses. There's one convenient to you.

In these times of increased demands, temporary shortages of a few insulators may exist in certain locations, but continuously adjusted production schedules quickly remedy such conditions.

Depend on Locke for Quality Controlled distribution materials . . . pole line hardware and insulators. One order covers both.

Locke POLE LINE HARDWARE and INSULATORS

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MARYLAND

alone, for partial softening with coincident turbidity reduction, or for complete softening and turbidity reduction.

The design is said to permit chemical reactions and separation of coagulated solids in only a fraction of the time necessary in intermittent cold process softeners. The retention time in a Cochrane Rapid Reactor will depend upon the characteristics of the raw water and the purpose for which the treated water is to be used, but usually is in the order of 60 to 70 min. compared to 4 hr or more with conventional cold process softeners or clarification systems.

•

Welding Presses

FOUR NEW MODELS of welding presses have been announced by Thomson Electric Welder Co, Lynn, Mass. Each is equipped with combination electrode holder and T-slotted knee and pad for interchangeable spot and projection welding.

The presses can be arranged for motor or air operation. They have transformers from 100 to 250 kva, capacity rated at 50 percent duty cycle according to RWMA standards. Features include V-type head slide and ways, and clamp-contact regulator. Work position is 44 in. from floor.

•

Current Transformer

A NEW CUSHIONED mounting for the porcelain in Allis-Chalmers Mfg Co through-type current transformers has been announced by the company from its plant at Pittsburgh, Pa. The porcelain serves as insulation for the one-turn primary in the unit.

The one-piece porcelain is suspended

inside the transformer housing by two continuous circular wedge-shaped rubber gaskets. The gaskets are held in place by clamping rings which maintain even pressure on the flexible gaskets and primary bushing. Effectual

What's YOUR I.Q. on Insulating Oil Purifiers?

Q. What is the most foolproof method of purifying insulating oil?

A. The De Laval Insulating Oil Purifier. By means of centrifugal force, it dehydrates and cleans transformer or switch oil. The filter press is needed only when colloidal carbon is to be removed.

Q. How many passes through the centrifugal oil purifier are required to purify the oil completely?

A. One and only one. The De Laval Oil Purifier dehydrates at a single pass. No re-running is necessary.

Q. Why is it an advantage to purify insulating oil at a low temperature?

A. It is safer than by methods demanding relatively high heat to drive off moisture. Low temperature purification prevents rapid reduction in dielectric strength of the oil after purification.

Q. Does the De Laval purify oil at low temperatures?

A. Yes. The low watt density electric heaters prevent carbonization of the oil.

Q. Are De Laval Purifiers economical to operate?

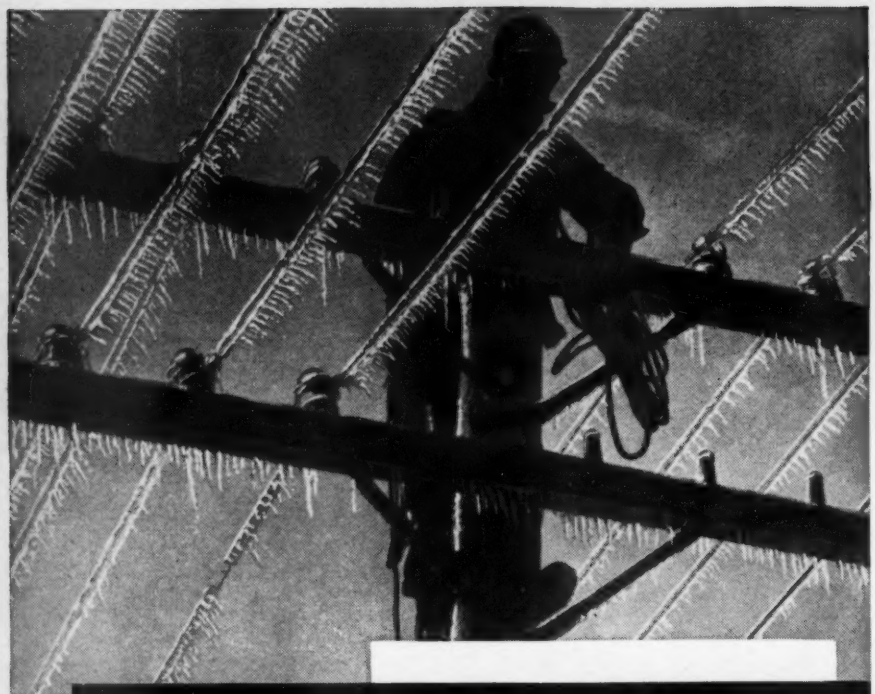
A. Yes. The Purifier purifies at constant high efficiency—no shutdowns for cleaning or for renewal of parts are necessary during a run.

De Laval

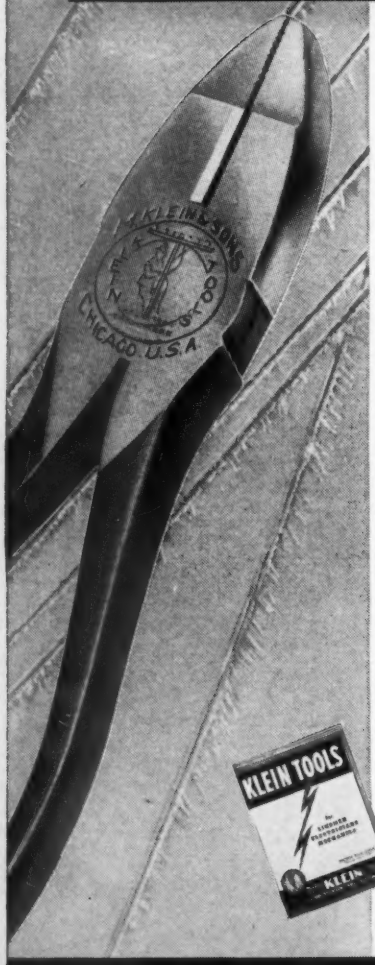
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

GET THE REST OF THE STORY IN BULLETIN #350

INSULATING OIL PURIFIERS



KLEIN PLIERS!



. . . PREFERRED BY LINEMEN

Wherever there are linemen . . . whatever the job—tough or routine—you'll find Klein Pliers.

There's good reason for this widespread preference that began when the electrical industry was in its infancy and has continued on through the years.

Linemen know they can depend upon the quality and performance of Klein Pliers. Drop forged from the finest alloy steel, each pair is individually tempered and tested—has the proper balance—just the right spring to the handles to minimize hand fatigue. A fitted hinge keeps jaws perfectly aligned—the carefully matched knives cut swiftly, surely and stay keen for years.

The complete Klein line includes pliers for every use. Your supplier will fill your order as quickly as possible.

Ask Your Supplier

Foreign Distributor: International Standard Electric Corp., New York

A copy of the Klein Pocket Tool Guide, showing the Klein line and containing valuable tool information, will be sent on request.

Since 1857

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

support is thereby provided against mechanical shock, and at the same time, the assembly can be mounted in any desired position.

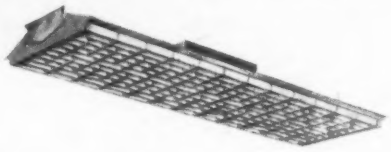
Space between the secondary winding and enclosing case is filled with an elastic compound. The compound is reported to seal out air and moisture and eliminates any tendency toward restricted breathing under temperature changes.

These improved transformers are available in current ratings above 1,000 amp and in voltages up to and including the 34.5-kv class. They are supplied in the circular window type for slipping over the primary bus structure or with the primary bar as an integral part of the porcelain and equipped with terminals for bolting in the primary circuit.

•

Fluorescent Fixture

THE DAYLITER is a new shallow-louvered unit for two 40 w lamps produced by Smithcraft Lighting Division of Chelsea, Mass. It is adaptable for



use in schools, offices, stores and institutions.

This unit features a newly designed louver which is stated to give greater cutoff from lamp glare—40 deg crosswise and 30 deg lengthwise. The fixture may be mounted individually or continuously; flush to ceiling or hung pendant on a stem set.

•

Germicidal Energy Meters

DEVELOPMENT of three new germicidal energy meters — reflectometer, watt-meter and ultraviolet intensity meter—have been announced by General Electric Co, Nela Park, Cleveland, Ohio. They have been designed to aid in the proper installation and maintenance of germicidal lamps.

Germicidal reflectometer was designed to measure the amount of germicidal energy reflected by walls and ceiling. It is in a metal case 4 in. by 3 in. by 6 in. and contains a U-shaped, 4-w, 215-v germicidal lamp, a microammeter and two light sensitive cells with filters. Scale reads percent of energy reflected by the test surface.

Germicidal wattmeter was developed to show directly the germicidal output of a lamp. It employs two light-sensitive cells with filters, is placed in direct contact with the lamp, and registers on

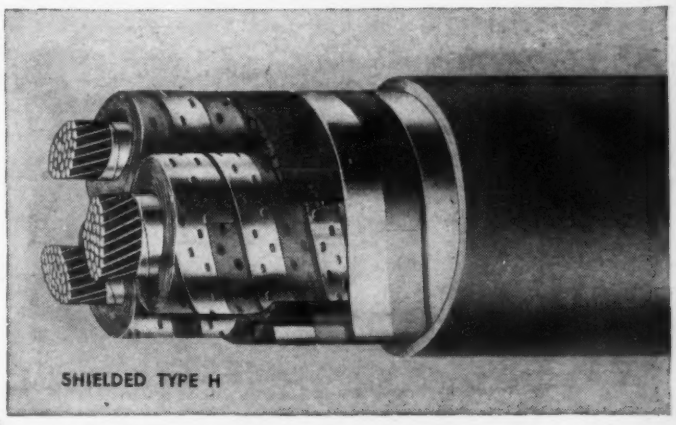
YOUR TROUBLES

GET RID OF OVERHEAD LINES and you get rid of exposure to storms and weather, costly maintenance and unsightliness. With Roebling Paper Insulated Lead Encased Cables your transmission, distribution and service circuits go underground . . . give you dependable, uninterrupted service at lowest obtainable cost.

Roebling Shielded Type H is being widely adopted for 3-phase grounded neutral circuits from 13 to 33 kv. This solid type cable is available both single and multiple conductor construction, in regular and Compack strand (round or sector). Conductors, shielded with metallized paper, are then individually insulated, protected with a perforated copper shielding tape, and the whole assembly served with a bronze binder tape. The finest materials plus Roebling engineering and production techniques give Shielded Type H characteristics of high importance in the utility field.

For a standard power cable or one manufactured for individual requirements, specify Roebling . . . your assurance of dependability and long-term low cost. A Roebling Field Man will be glad to help you select the *right* cable for specific service. Call him at our nearest branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities



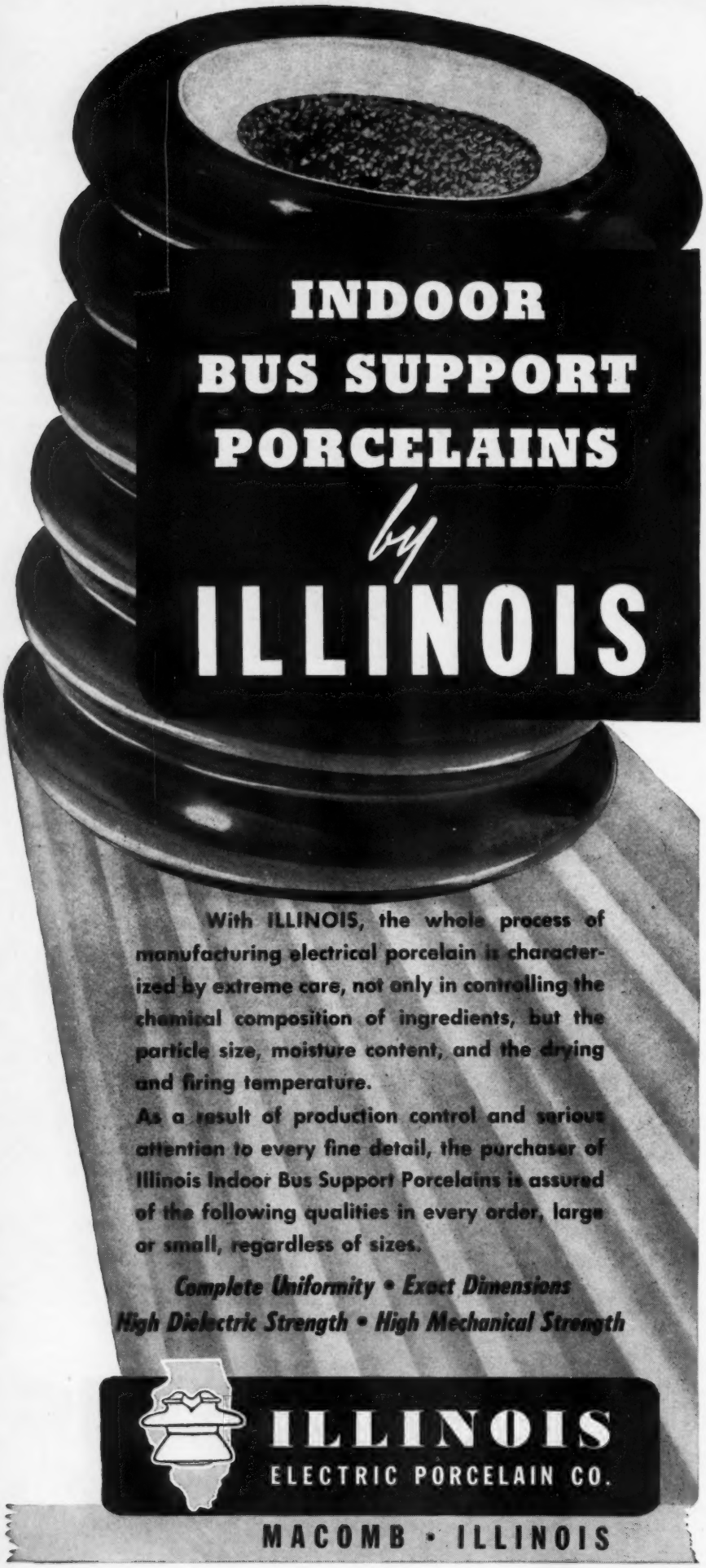
SHIELDED TYPE H

★ WIRE ROPE AND STRAND ★ FITTINGS ★ SLINGS ★ SUSPENSION BRIDGES AND CABLES ★ AIRCORD, AIRCORD TERMINALS AND AIR CONTROLS ★ AERIAL WIRE ROPE SYSTEMS ★ ELECTRICAL WIRE AND CABLE ★ SKI LIFTS ★ HARD, ANNEALED OR TEMPERED HIGH AND LOW CARBON FINE AND SPECIALTY WIRE, FLAT WIRE, COLD ROLLED STRIP AND COLD ROLLED SPRING STEEL ★ SCREEN, HARDWARE AND INDUSTRIAL WIRE CLOTH ★ LAWN MOWERS

ROEBLING

A CENTURY OF CONFIDENCE

JR ROEBLING


INDOOR
BUS SUPPORT
PORCELAINS
by
ILLINOIS
With ILLINOIS, the whole process of manufacturing electrical porcelain is characterized by extreme care, not only in controlling the chemical composition of ingredients, but the particle size, moisture content, and the drying and firing temperature.
As a result of production control and serious attention to every fine detail, the purchaser of Illinois Indoor Bus Support Porcelains is assured of the following qualities in every order, large or small, regardless of sizes.
Complete Uniformity • Exact Dimensions
High Dielectric Strength • High Mechanical Strength
ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB • ILLINOIS

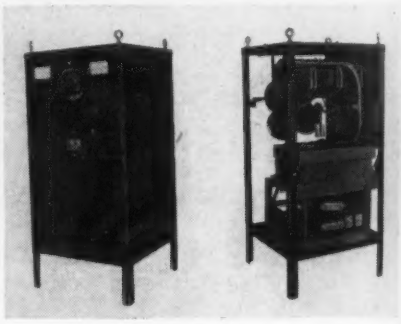
a direct reading scale the total output in watts of germicidal energy. It resembles a small mantel clock.

Germicidal ultraviolet intensity meter was designed to measure intensity anywhere in the room. It consists of a cadmium phototube and an amplifier contained in a 4 in. by 4 in. by 6 in. metal cabinet. The meter is said to be insensitive to natural or artificial light and can be used in a lighted room without being effected by visible radiation.

•

600-Amp Rectifier

A NEW LINE of low-voltage, high-current rectifiers is being manufactured by Mellaphone Electronic Rectifier Co, Inc, Rochester 2, N. Y. They can be operated from 220 or 440-v, 3-phase power lines. The d-c output voltage



can be varied from 0 to 6 v with a capacity of 600 amp or from 0 to 12 v with a capacity of 300 amp.

Primarily intended for use in electroplating and electrolytic cleaning, these rectifiers provide source of power for production testing, and running in of 6-v and 12-v d-c motors.

Features of the new rectifiers are: Sealed selenium rectifier elements; heavy-duty, variable-voltage transformers to provide smooth stepless control over output voltages, from zero to maximum setting.

Each unit includes 4½-in. ammeter and voltmeter, and also protection against overloads and failure of ventilation system.

•

Electric Machine Kit

EQUIPMENT TO DEMONSTRATE the principles of design, construction and operation of electric motors, d-c generators and a-c alternators, one, two and three-phase, is included in the Crow rotating electric machine kit. The equipment is made available by Universal Scientific Co, Inc, 1102 Shelby St, Vincennes, Ind.

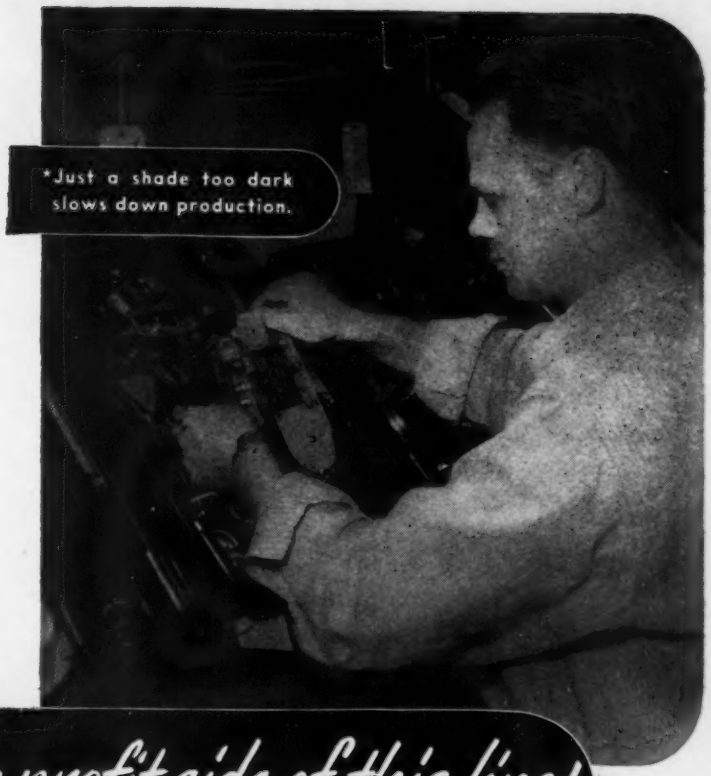
With the kit, it is reported that a student or instructor can build 132 different machines. Same basic parts

Borderline Vision*

may be fooling your customers!

● BORDERLINE VISION takes an expert to spot. But just the shade of difference between good lighting and not-quite-good-enough makes a big difference in production.

The best lighting today pays manufacturers big dividends in increased, better work—better employee morale—and decreased costs. Ever since 1881 Wheeler engineers have been paying these dividends to industry through Wheeler Skilled Lighting. Wheeler Reflectors give

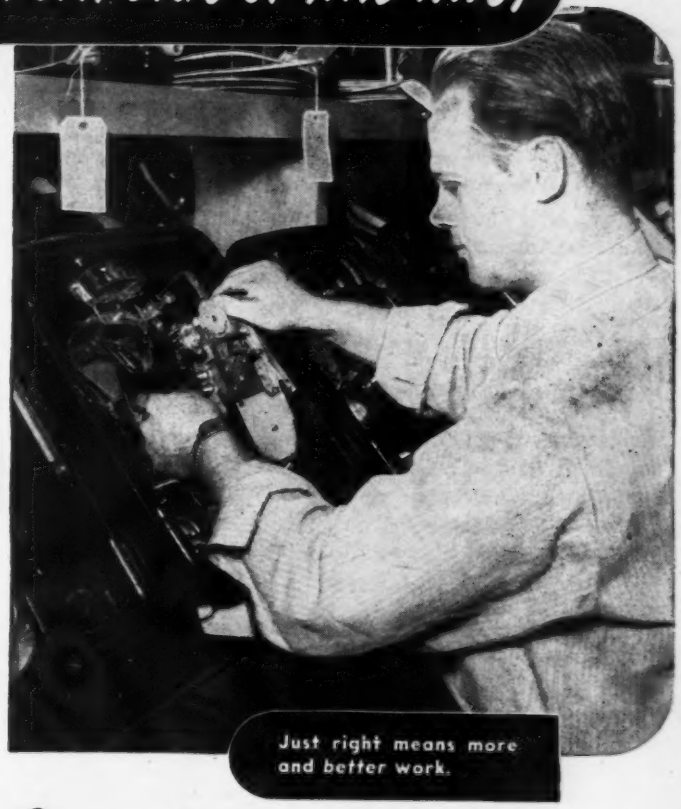


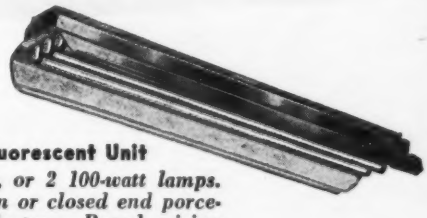
Put their plants on the profit side of this line!

maximum illumination from standard lamps because they *control* light. Their high reflection factor throws shadow-free light right on the job.

The difference between good lighting and Borderline Vision is easy to see in production figures when Wheeler Skilled Lighting is put to work in a plant. **Wheeler Reflector Co., 275 Congress St., Boston 10, Mass.** Also New York and principal cities.

Distributed Exclusively Through Electrical Wholesalers





All-Steel Fluorescent Unit
For 2 or 3 40-watt, or 2 100-watt lamps. Available with open or closed end porcelain enameled reflectors. Broad wiring channel with accessible enclosed ballast. For individual or continuous runs.

RLM Solid Neck Incandescent Reflector
Maximum lighting efficiency indoors or out. Expertly designed. Ruggedly built. Vitreous enamel only. 75 to 1500 watts.

Wheeler REFLECTORS

SKILLED LIGHTING

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

Turning "low hours" into "high load"—for you!

Here's a load-builder that works from *midnight to morning.* The General Electric Automatic Blanket!

And here's the kind of load you can expect—Two G-E Blankets equal one six-foot refrigerator in kilowatt hour consumption.

We're telling the story of G-E Automatic Sleeping Comfort. With full-color advertising in *Life, House Beautiful, Good Housekeeping, Time, This Week,* and *National Geographic.* And with plugs on the coast-to-coast radio show, "The G-E House Party."

Your customers—like more than half a million other enthusiastic users—are sure to love these cozy-warm, lightweight, electrically controlled blankets. So why not suggest them as gifts—for weddings, Easter, Mother's Day, birthdays.

Remember—*only* General Electric—the original automatic blanket—is available in a *full line.*

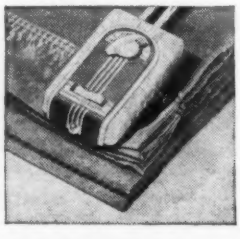
The One-Control Blanket (for three-quarter or double beds). The exclusive Two-Control Blanket for double-bed sleepers who like *different* degrees of sleeping warmth. And an exclusive new Twin-Bed Size in the One-Control model.

Write us today for ways to make this great "low hour" load-builder work for you! Appliance and Merchandise Department, General Electric Co., Bridgeport 2, Connecticut.

Automatic Blanket

"Goes to work when the lights go out"

Approved by Underwriters' Laboratories, Inc.



GENERAL ELECTRIC

(baseboard, frame ring, axle and self-aligning bearings) are used in every machine but changes are made in the position or type of the pole-piece or coils to construct different machines. The kit weighs 75 lb.

Machines can be operated on 110-v d-c, or 110-v, single phase, and 220-v, 3-phase. One assembled machine is 18 in. long, 11 in. wide 12½ in. high. It is rated at 300 w as a generator and approximately 0.5 hp as a motor.

A manual of instructions is available to illustrate and describe in detail all the machines which can be constructed with the kit.

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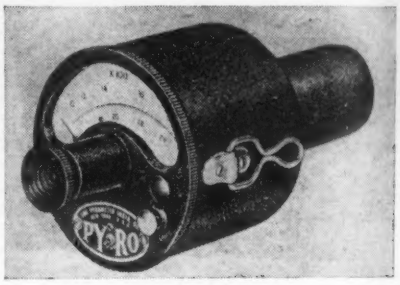
Pyrometer

A NEW RADIATION pyrometer has been designed to determine temperatures above 1000 F by thermo-electric princi-



ples. This new instrument is self-contained, said to weigh less than two pounds, is direct reading, requires no outside connections, and is produced by Pyrometer Instrument Co, 103 Lafayette St, New York City. The indicator locking device holds the pointer at the reading obtained until a button is pushed permitting the indicator to return to its zero position.

Operation of the pyrometer is based upon the established laws of radiant heat. A sensitive vacuum thermocouple within the instrument is sighted at the object being measured and the resultant electromotive force operates a galvanometer calibrated in direct degrees of temperatures. The instrument is constructed with a steel housing.

•

Slide Type Switch

THE 102 SLIDE type renewal switch which breaks both sides of the line has been developed by Congress Fan and Electric Co, Box 3747 Peninsula Station, Daytona Beach, Florida. This switch is non-snap, is 1⅜ in. high, 1½ in. wide and 1¼ in. deep.

Two pairs of beryllium strips face each other with a ¼-in. silver contact at each end. The contacts are pushed together by a flat plastic strip attached to a 3/16-in. push rod. Total travel is

Fusetrons Prevent Shutdowns—Save Costs

The cost of installing Fusetrons is mighty small compared to the losses incurred when a motor burns out. You have not only the cost of removing and replacing the burned-out motor, but the cost of the shutdown as well.

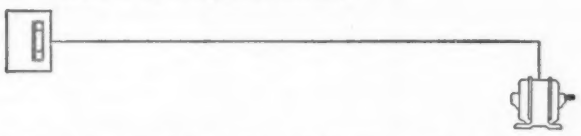
It will pay you to guard against these double losses by installing Fusetrons on small motor circuits such as pumps, fans, blowers, compressors, conveyors, mixers, grinders, stokers, oil burners — and hundreds of others.

FUSETRONS

Simple to Install

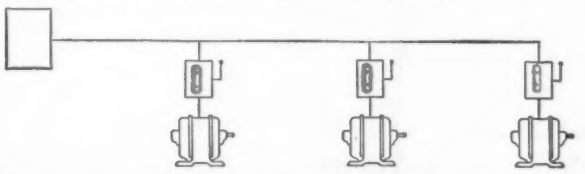
Just install a Fusetron of motor-running protection size anywhere in the circuit to handle only the motor current. Then on all normal installations, the motor will be protected against burnout due to lack of oil, worn bearings, tight belt, overloading — or anything that causes a dangerous excess of current through the motor.

If the motor is on a separate circuit,



a Fusetron of proper size in the switch or panelboard protects the motor and the circuit wiring.

If the motor is on a circuit feeding several motors,



install a Fusetron of motor-running protection size to protect each motor.

That's how simple it is to protect your motors from burnout — and yourself from losses due to motor burnout.

Fusetrons Give Many Other Kinds of Protection Heretofore Not Available

Fusetrons do everything fuses do, as is confirmed by Underwriters' Laboratories Label, and in addition . . .

✱ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. ✱ Give Thermal Protection to Panelboards and Switches. ✱ Lesser resistance means cooler operation and prevents needless blows caused by heating in panels and switches. ✱ Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel. ✱ On new installations, PROPER size switches and panels can be used instead of OVERSIZE. ✱ Protect small motors against burnout simply and inexpensively. ✱ Give DOUBLE protection to large motors. ✱ Provide simplest way to stop burnouts from single phasing. ✱ Protect coils, transformers and solenoids against burnout.

Get All the Facts—Get Better Protection—Send the Coupon Now!

Even one lost motor, or one needless shutdown or one destroyed panel may cost you far more than replacing every fuse with a FUSETRON.

Don't risk such losses — protect yourself by changing over the fuses in your entire electrical system to FUSETRONS.

BUSSMANN MFG. COMPANY
University at Jefferson, St. Louis 7, Mo.
(Division McGraw Electric Company)

BUSS FUSETRONS—SOLD THROUGH WHOLESALERS

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

*Name*_____

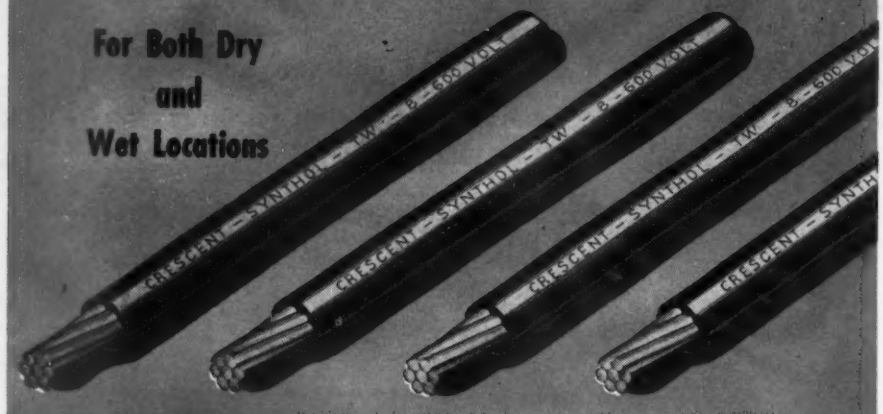
*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____ 248

CRESCENT SYNTHOL
TYPE TW
For Both Dry and Wet Locations



Synthol Type T. W. is the most desirable and lowest cost Building Wire for use in WET LOCATIONS under Sec. 3102b of the 1947 National Electrical Code in raceway systems: (1) Underground (2) In concrete slabs or other masonry in direct contact with earth (3) In wet locations (4) Where condensation or accumulation of moisture within the raceway is likely to occur.

CRESCENT SYNTHOL Building Wires and Cables are insulated with a special, tough, thermoplastic compound that results in wires of unexcelled Permanence, Safety, Adaptability and Value. They combine high dielectric and mechanical strength with the following desirable features.

SMALL DIAMETER —has smallest outside diameter for same conductor size, permitting more conductors, or larger conductors in same space.

FLAME RETARDING —SYNTHOL insulation will not support combustion.

LONG LIFE —practically unaffected by continuous exposure for years to sunlight or air; more stable than any rubber insulation.

RESISTANT to moisture, acids, alkali and most chemical solvents.

OILPROOF —cutting oils, greases and petroleum solvents do not injure SYNTHOL.

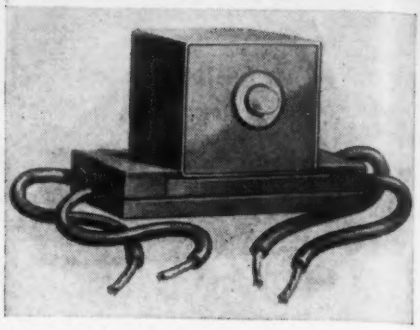
BRIGHT COLORS—non fading, the insulation is the same color throughout so color will not scrape off; easily cleaned; twelve colors.

FREE STRIPPING—makes splicing and soldering easier and faster.

EASY PULLING —because SYNTHOL wires have a permanent clear wax lubrication on their hard, smooth, abrasion resistant surface.

CRESCENT WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.



⅛ in. Pre-travel can be as small as 0.01 in. Pressure can be adjusted to as little as 1.5 oz. The switch can be normally open or normally closed and in double-throw in slightly larger sizes.

MORE NEW PRODUCTS
about which you should know

AGNEW ELECTRIC Co, Midford, Mich., has a type SPB-2 automatic **butt welder** with indexing table for small parts production of 3600 pieces per hour . . . Curtis Development & Mfg. Co, Milwaukee 10, Wis. developed feed-through **terminal block** for one to 16 terminals with both screw and solder connections . . . Hobart Brothers Co, Troy, Ohio, produces a copper-nickel **alloy electrode**, Softcast A, having a mineral flux coating for arc welding.

Chelsea Fan & Blower Co, Inc, Irvington, N. J., has two **propeller fans**, 20-in. for 3,000 cfm and 24-in. for 4,800 cfm, for air circulation in cold storage, milk cooling, meat storage and quick freezing rooms . . . Amerline Inc, Chicago 22, Ill., developed a **beam compass** with hard point for drafting table and soft surfaces, blunt point for metal and hard surfaces; used with steel rule to draw circles up to 12 ft in diameter . . . Slater Electric & Mfg Co, Woodside, N. Y., has constructed a one-piece ivory bakelite **fixture socket** with single screw mounting.

Sylvania Electric Products Inc, Salem, Mass., designed a combination fluorescent **lampholder** and starter with a locking ear "tab" on base to facilitate assembly to fixture . . . Nichols Wire & Steel Co, Davenport, Iowa, announces availability of Alumitel, an aluminum alloy No. 12 BWG (0.109 in. diam) **wire** processed for telephone and telegraph service . . . United Industrial Supply Co, Burbank, Calif., has a "cube" design extension **cord connector**; same design is offered in a 3-way tap.

Automatic Transportation Co, Chicago 20, Ill., is building an electric **fork truck** with 108 in. maximum lift,

Cole Electric Co.

8439 Steller Drive TExas 0-3243 Culver City, Calif.

OUTDOOR DISCONNECTING SWITCH
230,000 Volts 1200 Ampere Type MU
Three Pole, Single Throw
Group Operated

(1 pole shown)

MOSINEE

"More than Paper"

In the field of electronics and the electrical goods industry, MOSINEE stands for paper-base processing materials with scientifically controlled chemical and physical properties, high quality standards and dependable uniformity... with good dielectric strength, high tensile or tear strength; proper softness or stiffness; creped with controlled stretch or flexibility; specified pH for maximum-minimum acidity or alkalinity; accurate caliper, density, liquid repellency or absorbency . . . or other technical characteristics vital to your quality standards and production requirements.

MOSINEE PAPER MILLS COMPANY • MOSINEE, WIS.

"Essential Paper Manufacturers"

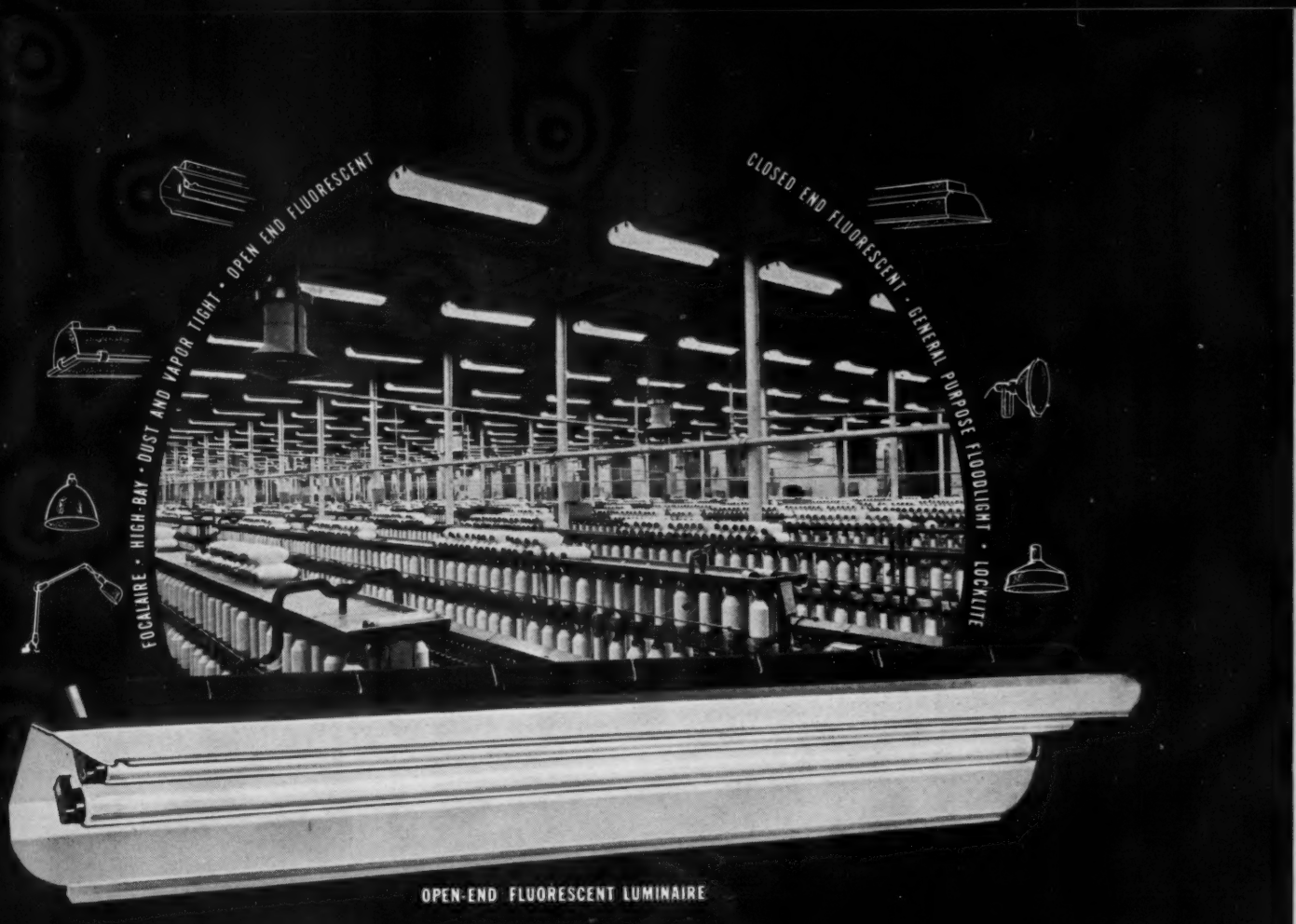
68 in. collapsed height, capacity 2000 lb and up to 48 in. loads . . . Precision Apparatus Co, Inc, Elmhurst, N. Y., announces a series 10-54 tube, circuit and battery **tester** which affords 35 a-c and d-c ranges to 6000 v, 60 microamperes, 12 amp. 70 db, and 60 megohms . . . Mine Safety Appliance Co, Pittsburgh 8, Pa., has a model B velocity-**power driver** (utilizing blank cartridge discharge as source of power to anchor pipe hangers and conduit boxes to structural plate or concrete.

Solar Capacitor Sales Corp, North Bergen, N. J., has a series of type FF fluorescent fixture Superex **capacitors** each in three ratings for operation at either 118, 208 or 236 v, 50-60 cycles . . . Schuyler Engineering Service, Chicago 25, Ill., has a battery selenium rectifier **taper charger** (4¼ in. wide 8½ in. high, 4 in. deep) which mounts permanently in automobile, includes 15 cp troublelamp, and emergency driving or tail lamp . . . Ideal Industries, Inc, Sycamore, Ill., announces a portable, **industrial cleaner** with 9-gal tank and dust bag and 1½-hp motor for vacuum cleaning, dust-collecting and water pick-up.

Potter Instrument Co, Inc, Flushing, N. Y., designed for radioactivity measurements a model 2092 **decade scaler** with decimal scale registration . . . Whitman Co, Los Angeles 23, Calif., manufactures Vitroseal an **insulative coating** to prevent spalling action and decreasing carbon, slag, and clinker adherence in fire boxes, furnaces and crucibles . . . Gerbing Manufacturing Corp, Chicago 11, Ill., has Roto-Cone variable pitch **pulleys** with V-groove, for ⅛ to 7½-hp ratings and for speed variations within a 3:1 ratio.

Island Equipment Corp, New York 17, N. Y. introduced a portable **belt conveyor,** known as "Styl-O-Veyor", with ¾-hp motor, vertical adjustment at center 24 in. . . .General Scientific Equipment Co, Philadelphia 32, Pa., makes available **safety clips** of stainless steel to keep 40 and 100-w fluorescent tubes in place when subjected to vibration . . . B. F. Goodrich Co, Akron, Ohio, announced new industrial **rubber wader** made in one pattern with shoe sizes from 8 to 11 inclusive, for use in wet and muddy locations.

Macleod & Hanspal, Charlestown 29, Mass., has a direct reading **megohmeter** with log scale and range of 1 to 100,000 megohms . . . Neoline, Inc, Los Angeles 12, Calif., designed a Neoprene **plug** which has a side entrance for an electric cord, to keep the cord flush against the wall . . . Trico Fuse Mfg Co, Milwaukee 12, Wis., announces an **automatic oiler** with plastic reservoir of 1-, 2- and 4-oz capacities and with spout off center for mounting clearance as little as ¾ in.


OPEN END FLUORESCENT · HIGH-BAY · DUST AND VAPOR TIGHT · FOCALAIRE
CLOSED END FLUORESCENT · GENERAL PURPOSE FLOODLIGHT · LOCKLITE

OPEN-END FLUORESCENT LUMINAIRE

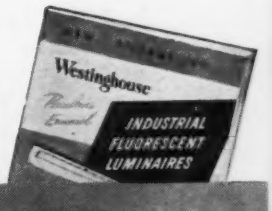
For Factories WESTINGHOUSE PLANNED LIGHTING PAYS

. . . WITH INCREASED PRODUCTION . . . LESS SPOILAGE AND REJECTS

HERE'S WHY. You get the right quality and quantity of light for every industrial task. The result: more production per worker . . . greater accuracy . . . better inspection . . . less spoilage and rejects . . . a safer plant and better labor conditions. No wonder Westinghouse *Planned Lighting* Pays.

THE RIGHT EQUIPMENT. Take a close look at the new Westinghouse Industrial Fluorescent: Built for long life . . . easy to install . . . easy to maintain . . . 9 mounting methods . . . enclosed hood protects ballast; improves appearance and rigidity . . . starters are easily, quickly accessible; readily identified . . . there is a complete line with open or closed ends; for individual or continuous strip mounting.

No matter what your lighting problem, you will find the answer in the wide range of Westinghouse fluorescent, incandescent and mercury-vapor equipment. A Lighting Sales Engineer will be glad to study your problems and help with a plan. For information call your nearest Westinghouse distributor, or send for a copy of B-3955. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-04155



Your local power company and electrical contractor will be glad to help with your planning

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Westinghouse Electric Corporation · Lighting Division · Cleveland, Ohio

COMMERCIAL · INDUSTRIAL · FLOODLIGHTING · STREET · AVIATION

Services of a Lighting Sales Engineer are available through your near-by Westinghouse distributor

NEWS ABOUT PEOPLE

Francis K. Godwin Elected Virginia Utility President

Francis K. Godwin has been elected president of the East Coast Electric Co, West Point, Va. J. G. McClellan, president for many years, has been made chairman of the board.

Godwin, a Missouri native, entered the utility industry as a clerk in the

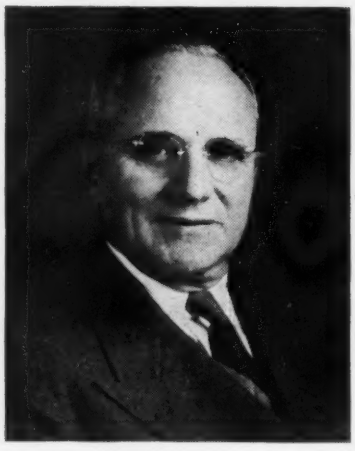
F. K. GODWIN

gas division of the Oklahoma Utilities Co in 1929. He advanced rapidly and by the end of 1930 was district manager at Fairfax.

During the early '30's, he took an active part in the campaign to combat the wave of municipal ownership agitation which was sweeping the state. In 1933, he served as secretary and the following year as chairman of the Electric Division of the Oklahoma Utilities Association. As a member of the Association's speakers bureau, he made many talks in favor of private ownership.

In 1935, Godwin became electric division manager. The following year, he went to Findlay, Ohio, to take charge of advertising and new business for Central Ohio Light & Power Co. Two years later, he went to Englewood, Colo. as district manager for Colorado Central Power Co. In 1939, he was back with Central Ohio as Western Division manager.

He returned to Colorado Central Power in 1944 as assistant general manager. The following year, he was made vice-president and general manager, the positions he last held.



A. H. MEYER

Chicago Lighting Institute Now Headed by A. Meyer

A. H. Meyer, manager of General Electric Co's Midland Sales District, became president of the Chicago Lighting Institute on Jan 1. He has been vice-president of the Institute for the past several years. His predecessor as president was Ralph Raymond, manager of electricity sales of Commonwealth Edison Co.

Meyer began his electrical career in Chicago in 1910, soon after receiving his electrical engineering degree from the University of Nebraska. He has held his present position with General Electric for over 30 years.

•

▶ IVAN BLOCH, formerly chief of the Bonneville Power Administration's division of industrial and resources development, and for the past 6 months industrial consultant to the Interior Department's Pacific Northwest coordination committee, has resigned. Mr Block is entering private practice as an industrial engineering consultant with headquarters in Portland. He joined the BPA staff in 1938.

▶ HARRY D. HAIN has resigned as general manager of La Salle Lighting Products, Inc., to enter sales consultant work. Mr Hain was appointed general manager of La Salle in 1936. He had formerly been sales manager of the Railley Corp, Cleveland.

Charles P. Collins Heads Norma-Hoffman Bearings

Charles P. Collins took office as president of the Norma-Hoffman Bearings Corp, Stamford, Conn., on Feb 1. Since 1942, he has been associated with SKF Industries, Inc, Philadelphia, and since 1943, has been secretary and general counsel.

A native of Cleveland, Ohio, Collins was educated at Princeton, Columbia

C. P. COLLINS

University Law School, and New York University Law School. From the latter he received his bachelor of laws degree in 1928.

He has contributed articles for legal, banking, and commercial publications on trusteeships, commercial contract clauses, and economic principles.

•

▶ GEORGE R. MARRS has been appointed treasurer of the Texas Power & Light Co, succeeding J. E. VAN HORN, retired. Mr Marrs became identified with TP&L in 1924 and has been assistant vice-president since 1933.

▶ WILLIAM T. MCCULLOUGH, JR, has been appointed manager of stationary boiler sales of the Babcock & Wilcox Co, New York. Mr McCullough has been with the Babcock & Wilcox organization since 1915. He transfers to the New York office from Chicago where he has been sales manager since 1938. Immediately following his graduation from Georgia School of Technology,

"KEY PEOPLE"—*When You Need Steel*

Ryerson's function is not only to supply your steel, but to deliver it on time. From the moment the Ryerson switch-board flashes your incoming call until the steel is laid down in your plant, a corps of helpful, intelligent employees well-trained in the Ryerson "Immediate Steel" tradition are at your service.

The likeable young women at the switch-board, phone-order salesmen, dispatchers, crane operators, skilled warehousemen who cut, shear and shape stock sizes to fit your specification, truck drivers—all of them are key people at Ryerson—key people in your service, when you need steel!

In spite of shortages, we are putting forth every effort to serve all Industry to the best of our ability. Naturally, many sizes and certain products are out of stock. However, for the most part you can depend on Ryerson for immediate shipment of a wide range of steel products.

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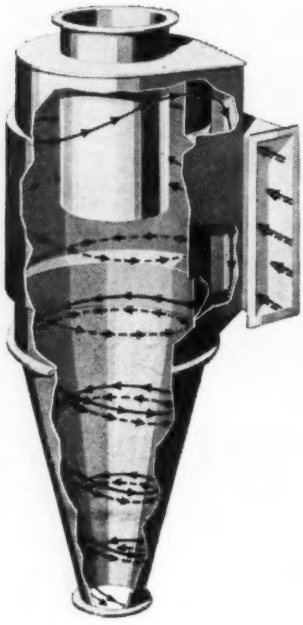
Bars—hot and Cold rolled	Mechanical Tubing	Tool Steel
alloy steel	Boiler Tubes and Fittings	Wire, Chain
reinforcing	Allegheny Stainless—	Bolts, Rivets
Structurals	sheets, plates, shapes,	Babbitt
Plates—	bars, tubing, etc.	Metal Working Tools
Inland 4-Way Floor Plate	Sheets and Strip Steel	& Machinery, etc.

JOSEPH T. RYERSON & SON, INC., Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles

RYERSON STEEL

in planning
Fly-ash control



The "Brass Tacks" Approach

is to get down to fundamentals. What equipment will collect dust particles in the sizes that count, with an efficiency you can count on, and at the most practical cost.... For economy, a system's got to be simple — without moving parts or need for maintenance. That means a Buell van Tongeren Cyclone, if you really want to trap the low-micron fines, too. Only the van Tongeren has the Shave-off, to put it in the high efficiency class. A Buell catalog makes this all plain. Write for one, its "brass tacks" approach makes it easy to read.

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Engineered Efficiency in DUST COLLECTION

Mr McCullough went to work in the company's plant at Barberton, Ohio. He was district manager of the Cincinnati office and later of the Pittsburgh office before heading the Chicago office of the company. C. O. HOBAN has been named acting sales manager, Chicago district. R. J. ROBINSON has been appointed district sales manager of the new St. Louis district of the company.

•

Robert Allison Heads GE Wire and Cable Division

ROBERT P. ALLISON, JR, has been appointed manager of manufacturing of the company's wire and cable division, succeeding S. T. Powell, who has retired from the company after 39 years' service. Mr. Allison was formerly manager of the Marginal St Works in Lowell, Mass. He started with General Electric in 1935.

B. A. CASE has been appointed a member of the design engineering staff of the apparatus department. In addition to following the engineering activities of certain assigned divisions of the department, he will co-ordinate all phases of engineering cost reduction work. Mr. Case joined General Electric in 1927.

MORRIS C. HIXSON has retired as manager of Pacific Sales District of the General Electric lamp department at San Francisco. He has been succeeded by F. M. FALGE, who has been serving as assistant manager. Mr. Hixson, a member of the company for approximately 36 years and manager of the lamp department's Pacific sales district since 1934, is widely known in the electrical industry on the West Coast. Mr. Falge joined GE as a lighting sales engineer for the lamp department at Nela Park in 1926. After an association with Paramount Publix Corp, he returned to Nela Park in 1931, where for 7 years he specialized in stage and theater lighting, photographic lighting, sign, display and architectural lighting. After an assignment for the lamp department at Los Angeles he entered the Navy and following service returned to the lamp department at Nela Park in 1945.

•

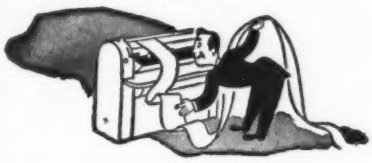
▶L. W. LONG, formerly manager of the substation section of the Allis-Chalmers West Allis electrical department, has been named general manager of the company's Boston Works. Mr Long entered the employ of the Pittsburgh Transformer Co in 1925, which was later acquired by A-C. In 1943 he was transferred from the Pittsburgh Works to West Allis as sales engineer-

NEW! THE OZALID STREAMLINER

• Reproduces your engineering and architectural drawings in seconds—also your typed, printed, photographic material.

• Moderately priced . . . designed for the thousands of drafting rooms that want these 5 EXTRA VALUES in Printmaking at no extra cost—

1. EFFICIENCY! You always get positive (not negative) prints direct from your tracings . . . prints that are sharper, brighter, much easier for you to read, check, and make notations on.



You produce these without waste of material or waste of motion. Your tracings can be up to 42 inches wide, any length . . . and can be printed either on rolls of Ozalid sensitized paper or on cut sheets of matching size.

Your prints are always delivered dry, ready for immediate use . . . after just two simple operations—Exposure and Dry Development.

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3. ECONOMY! An 8½ x 11-inch reproduction costs you *one cent;* 11 x 17 inches, two cents . . . and so on. The Ozalid Streamliner soon pays for itself . . . in time, labor, and dollars saved.

With it, you can also effect amazing short cuts in design. For example—eliminate redrafting when changing obsolete drawings . . . combine the details of separate tracings on *one* print . . . re-

claim old or worn tracings . . . make transparent overlays in different colors.

4. VERSATILITY! You can reproduce the lines and images of any original in black, blue, red, sepia, or yellow . . . on paper, cloth, foil, film, or plastic.

Simply use the Ozalid sensitized material you think best for job at hand; e.g., use identifying colors for prints of separate departments or operations . . . DRYPHOTO to produce beautiful con-

tinuous-tone prints from film positives (which can be made from any negative) . . . OZAPLASTIC to produce oilproof, waterproof prints for shop or field use. *All* prints are made in same fast, economical manner.

5. SIMPLICITY! NOW—printmaking is an easy desk job, automatic in practically every detail.

Anyone can feed originals and sensitized material into the Ozalid Streamliner. Prints are delivered on top, stacked in order—within easy reach of the operator, who does not have to leave her chair.

You can install your Streamliner anywhere; it requires only 11 square feet of floor space.

Write today for free, illustrated booklet . . . showing all the ways you can use the new OZALID STREAMLINER . . . and containing actual reproductions — like those you can make.

Gentlemen: DEPT 29

Please send New Ozalid Streamliner booklet . . . containing reproductions of drawn, typed, printed, and photographic material. No obligation.

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Johnson City, New York

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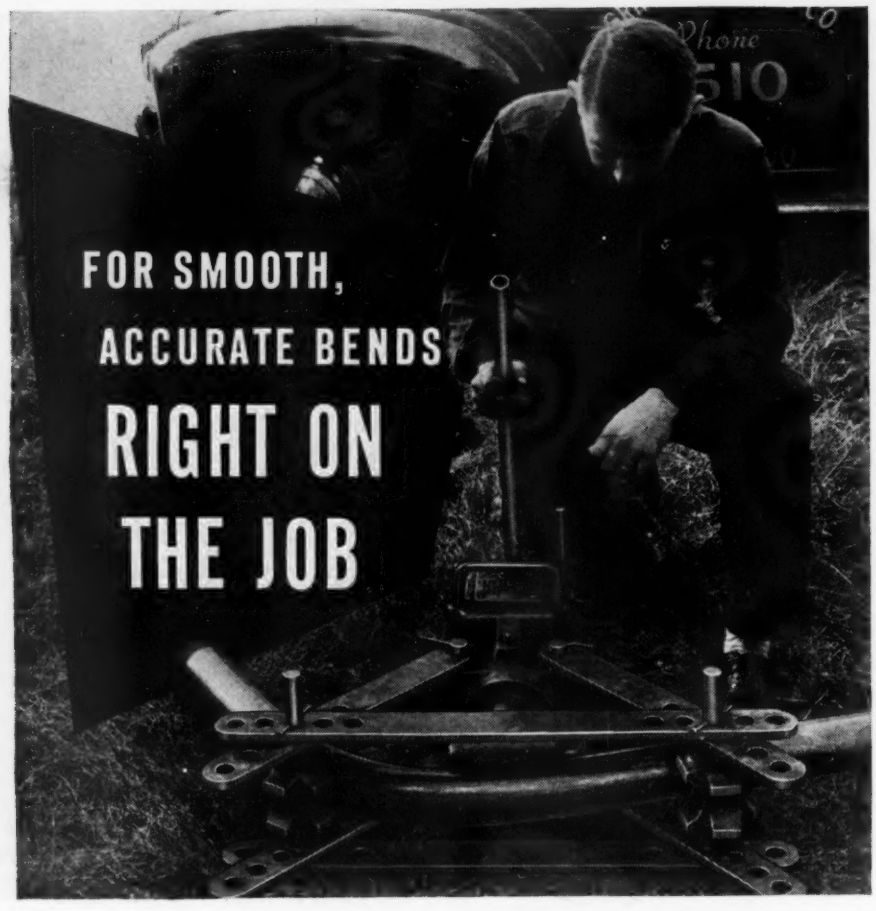
Hughes Owens Co., Ltd., Montreal



GREENLEE HYDRAULIC BENDER

Whatever the job location, the portable GREENLEE Hydraulic Bender can be taken *right to the spot* where the work is to be done.

Bends are quickly made exactly where and when wanted . . . tailored to the exact requirements of the installation. For example the GREENLEE Bender owned by the Griffin Electric Company of Owensboro, Kentucky, is shown above on job location where it was used to bend various sizes of conduit from ½" to 4½".

"Where promptness and swiftness are the main factors on a job, the GREENLEE is always used to save time and materials and eliminate need for manufactured fittings," reports this company.

With the GREENLEE, *one man* quickly makes smooth, precise bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. This means as high as 75% labor savings, many owners report, with material spoilage reduced to practically nothing.

Get facts today on the timesaving GREENLEE Hydraulic Bender which often pays for itself on the first few jobs. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1802 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

in-charge of mixed apparatus sales. R. O. BELL succeeds Mr Long at West Allis. Mr Bell has been connected with A-C since 1936, recently as engineer-in-charge of transformer sales. JAMES R. MANN has been named to succeed Mr Bell.

•

Sales Changes Announced by Westinghouse Subsidiary

Three changes in the sales organization of Westinghouse Electric International Co were announced recently.

Robert H. Harris, sales manager, has been made assistant general manager to replace Douglas C. Lynch. Harris has been succeeded by Carl E. Dreher.

Lynch is on a leave of absence to go to Brazil as executive director of Laminacao National de Metais S A, Sr Francisco Pignatari's industrial company which holds Brazilian licenses for production of many Westinghouse products.

Harris, a native of Philadelphia, joined the parent Westinghouse Electric Corp in 1933. He transferred to International in 1935. During the war, he served as a lieutenant colonel on the War Department General Staff Corps for over four years. On his return in September, 1945, he became manager of elevator and air conditioning apparatus. He is an electrical engineering graduate of Lehigh University.

Dreher has served the company in Brazil and South Africa. Before his promotion he was head of the western hemisphere department in the New York office. He is a graduate of Brown University.

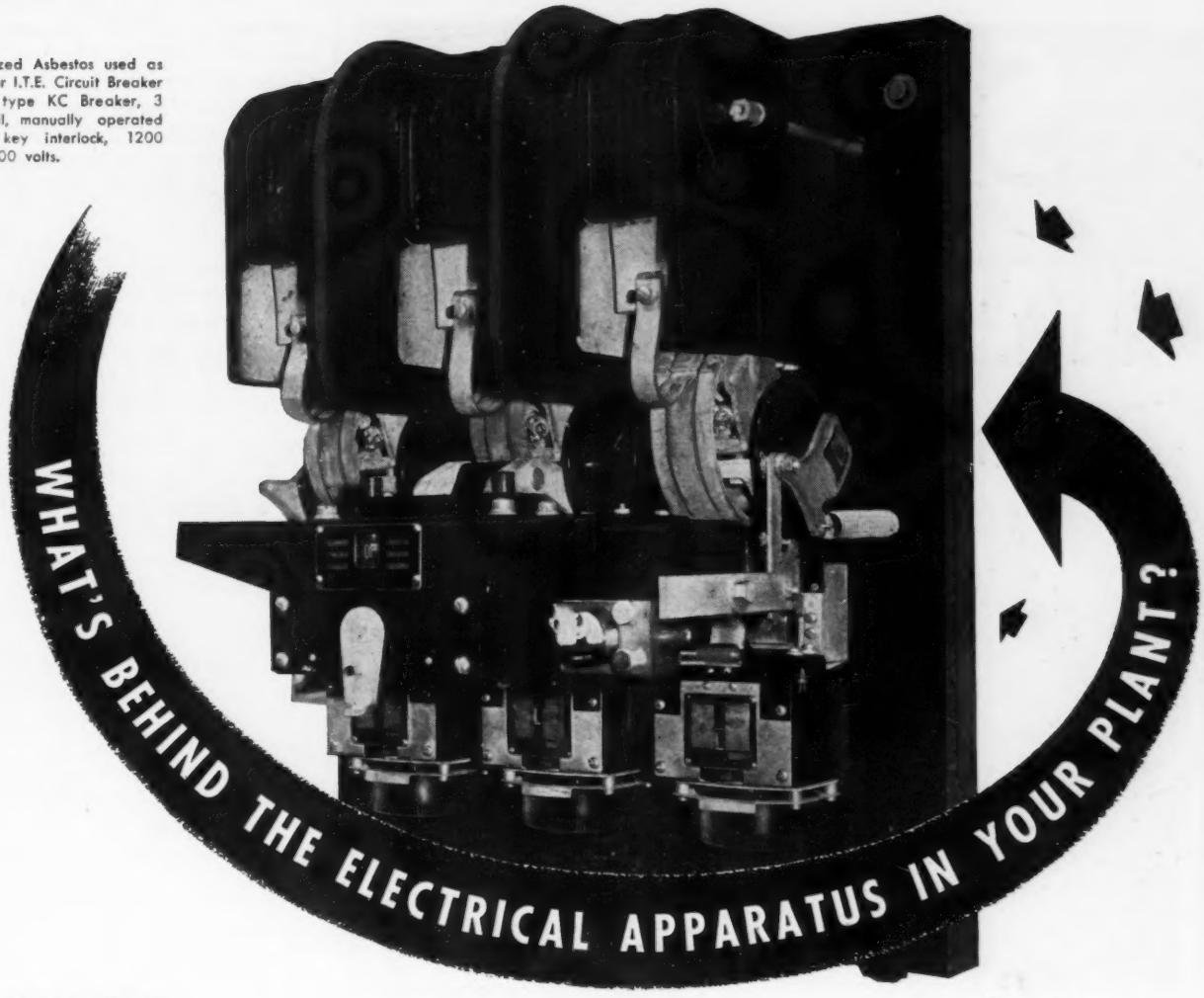
•

► JOHN F. DREIER has been appointed sales manager of the Hart Mfg. Co, Hartford, Conn. He succeeds the late Frank W. Watts. Mr Dreier is a graduate of the Bliss Engineering School, Washington, D. C., and for the past 15 years has been active in electrical sales and manufacturing fields.

► DR CHARLES A. THOMAS, executive vice-president and technical director of Monsanto Chemical Co, and a key figure in the development of the atomic bomb, has taken office as 1948 president of the American Chemical Society.

► ROY B. SNAPP, who has been acting secretary to the Atomic Energy Commission since last October, has been appointed secretary to the commission. Mr Snapp began work in the atomic energy program in 1946 as special assistant to the commanding general of the Manhattan Project. He became special assistant to the general manager of

K&M Ebonized Asbestos used as the base for I.T.E. Circuit Breaker Company's type KC Breaker, 3 pole, 3 coil, manually operated and with key interlock, 1200 amperes, 600 volts.



K&M Ebonized Asbestos

Check the apparatus mounting materials in your plant, compare them against these features of K&M Ebonized Asbestos:

1. Unusually strong—both dielectrically and mechanically.
2. Highly resistant to shock, vibration, temperature changes.
3. Easy to machine, easy to cut and drill, easy to handle.
4. Supplied in thicknesses up to 4 inches.
5. Uniform consistency—no veins to make it chip or crack.
6. Neat, efficient appearance in finished units.

Ebonized Asbestos is a combination of asbestos fibres, Portland cement and an insulating compound. Moulded under tremendous hydraulic pressure, these ingredients form a tough dense sheet that lends itself to practically every mounting requirement. When built into assembled units, it meets the technical requirements of Underwriters' Laboratories, Inc. Write us for full facts about K&M Ebonized Asbestos—we'll answer promptly.

Nature made Asbestos . . .

Keasbey & Mattison has made it serve mankind since 1873.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

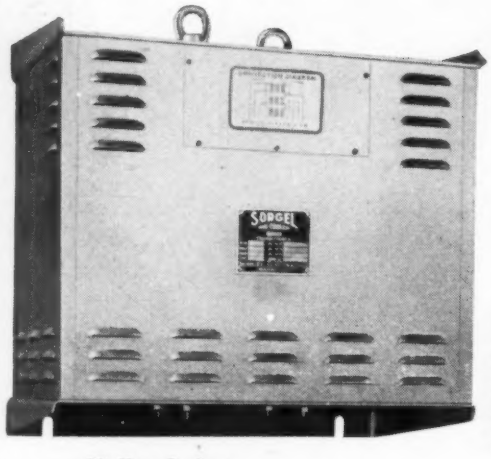
IN CANADA—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

SORGEL AIR-COOLED TRANSFORMERS

are the **Latest Development** *in*

Dry-Type Transformers

Liberal Design
Steel Encased
Solderless Terminals
ConnectionCompartment



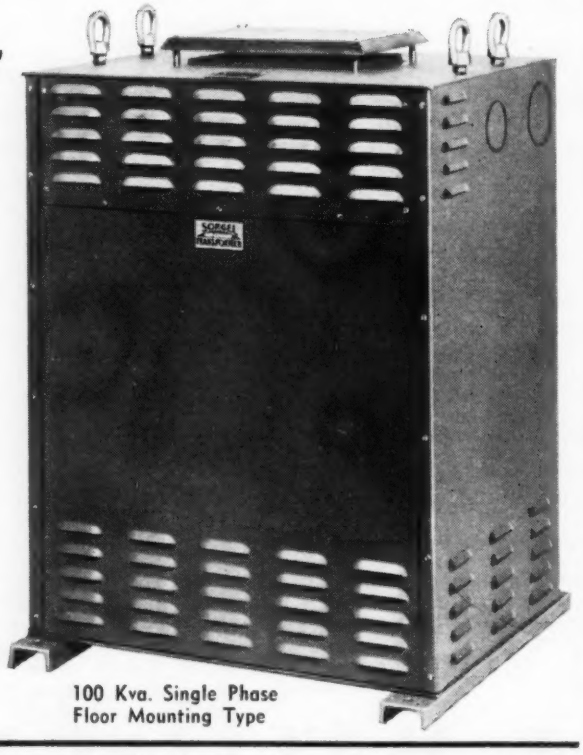
50 Kva. 3-phase
Wall Mounting Type

Over 30 Years' Experience

Leaders— with the latest improvements and refinements.

This is our Principal business— not a side line.

A size and type for every purpose.
1/4 to 1000 Kva.
All voltages.
115 volts to 15,000 volts.



100 Kva. Single Phase
Floor Mounting Type

SORGEL ELECTRIC CO., 834 W. National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled transformers.

the commission last January. For 4 years during the war he was secretary to the military intelligence staff of the Combined Chiefs of Staff of the United States and British forces. Before entering military service he was an attorney in the State Department.

▶ GEORGE W. WILLIAMSON, treasurer of the Commonwealth Edison Co, Chicago, has been elected vice-president and treasurer. J. HARRIS WARD has been elected secretary to succeed JOHN W. EVERS, who will devote himself exclusively to the vice-presidency of the company.

▶ CLIFFORD C. TIPPIT, formerly a methods supervisor with the Reliance Electric & Engineering Co, Cleveland, has been made manager of a newly created order and planning department. He joined Reliance in 1945.

▶ RAYMOND HUCK has been made president of the Ohio Rural Electric Cooperatives, Inc. Mr Huck has been active in local farmer and rural electric cooperatives since 1932.

▶ JOHN P. MADGETT has been appointed general manager of the Dairyland Power Cooperative, La Crosse, Wis.

▶ OWEN W. HURD, assistant manager and district engineer for the Bonneville Power Administration at Spokane, Wash., has been appointed manager of the Benton County PUD at Kennewick, Wash. Mr. Hurd succeeds J. B. WHITEHEAD of Prosser, who resigned to devote full time to his duties as manager of the Benton Rural Electric Association.

▶ OLIVER JOHNSON, assistant manager of the Polk-Burnett Electric Cooperative, Centuria, Wis., has been named manager of the St Croix County Electric Cooperative, Baldwin, Wis.

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OBITUARY

Albert F. Morairty

Albert F. Morairty, who until his resignation in 1946 was vice-president of the Central Arizona Light & Power Co, died Jan 29 in a hospital at Phoenix. Death was caused by a brain concussion which he received Jan 17 when he fell on a highly polished concrete floor at the Jokake Inn. He has been managing partner of Camelback-Jokake Properties, a residential development and resort hotel near Phoenix, since he left the utility.

For 20 years Morairty was active in furthering industry and electrical progress in Arizona. Born in Boulder, Colo., in 1888, he was graduated from the University of Michigan in 1911 as an elec-

Here's a strand that's easy to handle—one you can bend without maiming it for life. Bethlehem strand is never cranky or stubborn; doesn't suffer tortures when you loop it.

Neither does the coating. In Bethlehem strand, the wires are protected by rust-resistant bethanized "armor"—an outer thickness of highly-pure zinc that is applied electrolytically. This process, exclusive with Bethlehem, is more than just a method of bonding zinc to wire. It creates a jacket so ductile that even the cruelest bending doesn't disturb it.

Another feature is uniform coating-thickness. No isolated thin spots; no "ripples." Whether you pick an A, B, or C coating-weight,* the wires of your Bethlehem strand are protected fully and evenly, all the way around.

Why not let us tell you the whole story? Glad to, any time. Simply call in the nearest Bethlehem representative.

* A—equivalent to extra-galvanized; B—twice the weight of A; C—three times the weight of A.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

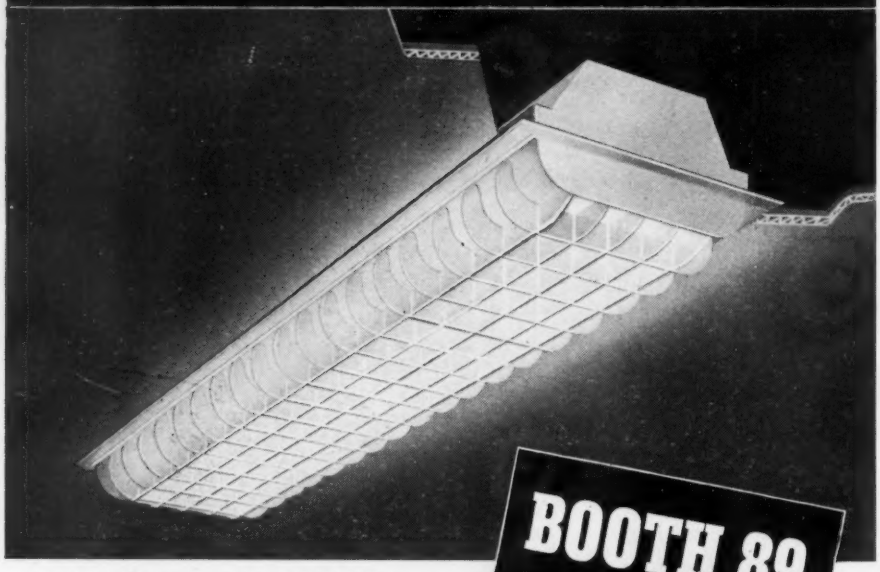
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHANIZED STRAND

BE SURE TO SEE IT!

THE NEWEST, MOST EFFICIENT TROFFER IN THE LIGHTING INDUSTRY



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Directly across from the Electrical Contractors Association

ST. PAUL AUDITORIUM

ST. PAUL, MINN.

MARCH 1st - 4th

PLANET FLUORESCENT

TROFFER

Trim, slim, beautiful . . . gives that modern, up-to-date look, while offering *today's best* over-all illumination.

HERE ARE JUST A FEW OF ITS MANY UNIQUE FEATURES

- Install as single units or continuous runs
- Spreads light on ceiling as well as downward
- Easy installation — requires only 5½ inches of space above ceiling
- Handsome hinged louver or framed glass panels
- Available for 2, 3, or 4 40-watt fluorescent lamps
- Special curved glass panel gives maximum light distribution. Steel louver finished in high reflectivity baked white fluorescent enamel. Special plastic sides on louvered unit afford perfect shielding and illumination.

This is only one of the many superior lighting fixtures manufactured by Planet Products, Inc.

DETACH, FILL OUT AND MAIL

Gentlemen:

Please send me, free of charge, complete literature regarding Planet Products lighting fixtures.

Name_____

Name of Company_____

Address_____

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IF YOU CANNOT ATTEND THE LIGHTING EXHIBITION, SIMPLY FILL OUT AND MAIL THIS COUPON.

PLANET PRODUCTS, INC.

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trical engineer. He joined the Colorado Power Co as a construction worker and rose through the operating side. Under the Public Service Co of Colorado, a successor company, he became manager of the Alamosa district in charge of the entire San Luis Valley.

In 1925, he went to Phoenix to set up the sales department for Central Arizona. He was made assistant general manager in 1936. Five years later he was made vice-president in charge of sales. He served a term as president of the Arizona Utilities Association.

•

Dr August C. Klein

Dr August C. Klein, 61, vice-president and engineering manager. Stone & Webster Engineering Corp, Boston, died of a heart attack on Feb 3. He was on a vacation trip to Jamaica.

Klein joined Stone & Webster after World War I. His first position was

that of gas engineer. His activities were soon enlarged to cover steam power and chemical plant design. He became a noted authority on depreciation and public utility rates.

In 1929, Klein became chief mechanical engineer, in 1945 engineering manager, and in 1946, vice-president.

During the last war, he supervised the engineering design of the first atomic pile at the Argonne Laboratory and the electromagnetic uranium separation plant at Oak Ridge. He was also in charge of the layout and design for the town of Oak Ridge.

Klein was a mechanical engineering graduate of Stevens Institute of Technology. Until his service in the army in the first World War, he was an engineer with the United Gas Improvement Co, Philadelphia.

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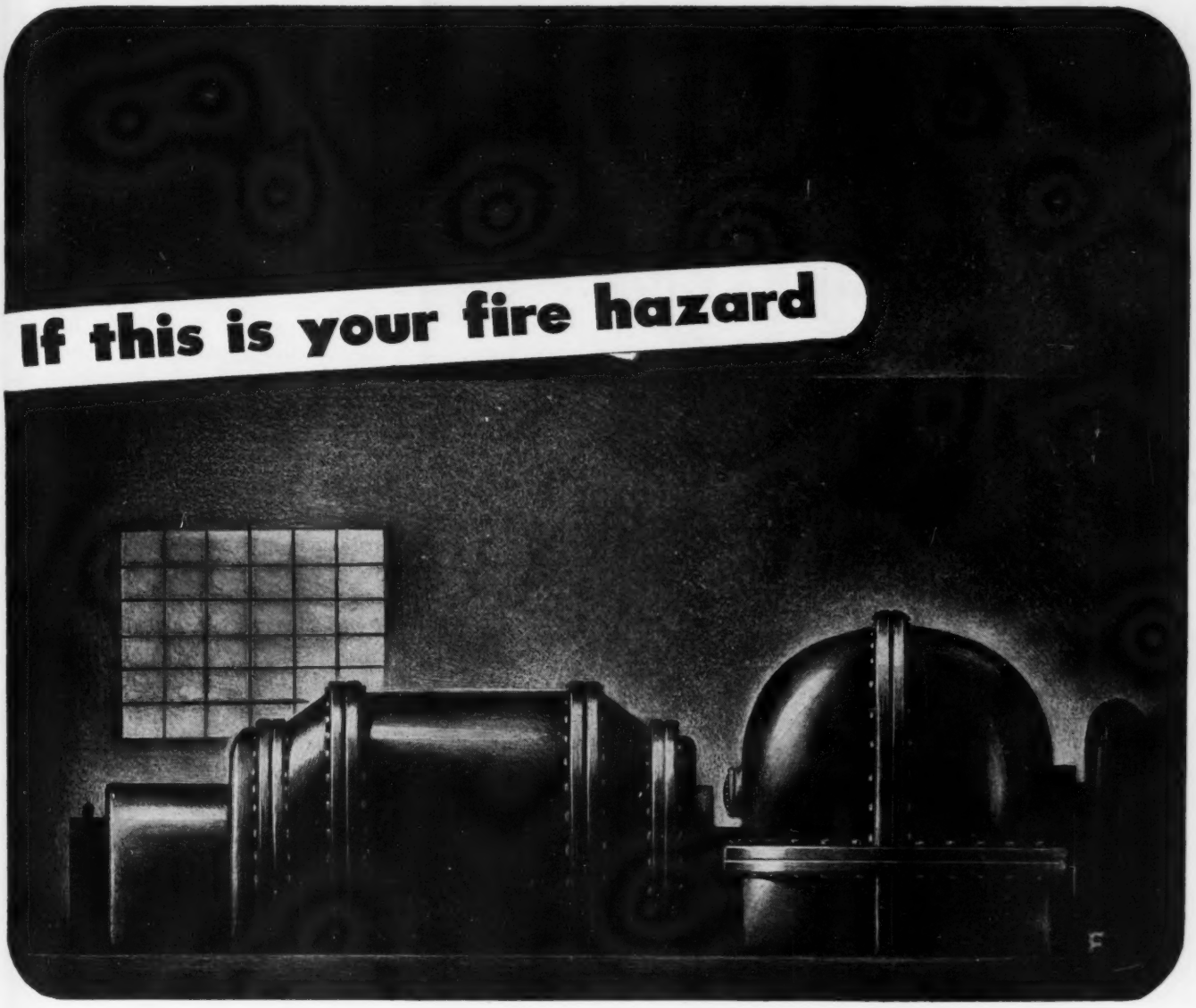
▶ THORLEIF THORSTEN, chief mechanical consulting engineer for West Penn Power Co and West Penn Electric Co, died Feb 1 in a Pittsburgh hospital. Born and educated in Norway, he came



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APPLY CARBON DIOXIDE WITH A KIDDE BUILT-IN SYSTEM

The *Kidde* system feeds a heavy initial discharge of carbon dioxide (CO_2) right into the recirculating ventilating system of a rotating machine—to kill flames.

Additional carbon dioxide during the run-down period maintains an inert atmosphere—prevents glow from rekindling.

Method of operation? Manual or automatic, by means of thermal devices or differential relays.

Easily-installed automatic dampers adapt system to non-recirculating ventilation systems.

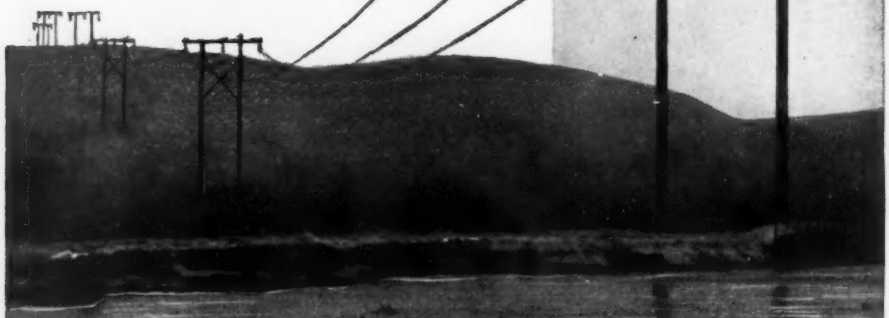
Remember . . . CO_2 is dry, inert, non-conducting, clean.

Plan this protection now for your new rotating machinery—install it on your present equipment. A Kidde representative will give you full details.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc.
230 Main Street, Belleville 9, N. J.

BAXCO
LONG LIFE
DOUGLAS FIR POLES



Our specialty is long-length Douglas Fir poles, pressure treated for Long-Life service. Prompt shipments of reasonable quantities can now be made in most lengths from 60 foot to 125 foot. Direct rail shipments out of our treating plant stocks can be made to any point in the United States. Write or wire us your inquiries.

Pressure treated Douglas Fir poles have been for years the standard in pole line construction on the West Coast. BAXCO Long-Life Douglas Fir poles meet ASA Specifications and are pressure treated with coal-tar creosote or creosote-pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

BAXCO Long-Life Douglas Fir poles, pressure treated from high quality Coast-type timber, will cut your maintenance costs and yield longer and more satisfactory service.

Also Produced by J. H. Baxter & Co. of Oregon—*an associated company*
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LOS ANGELES · LONG BEACH · ALAMEDA · CALIFORNIA, U. S. A.

to the United States in 1906. Before joining the West Penn System, he worked for a number of concerns including Babcock & Wilcox Co and Sargeant & Lundy. As chief mechanical engineer for West Penn, he designed the mechanical equipment for the Springdale and Windsor Plants. He also designed a number of other buildings for West Penn.

▶ EDWARD A. HANCOCK, 58, manager of the industrial division, New England District, General Electric Co, Boston, died suddenly, Jan 31, at Brooklyn. He had been with GE since his graduation from Pratt Institute in 1912.

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Dean George F. Bateman

George F. Bateman, dean of the Cooper Union School of Engineering, New York City, since 1933, died of heart illness, Jan 29. He was graduated from Cooper Union in 1907 and immediately joined the faculty.

He was president of the New York Electrical Society, 1944 to 1946, and a director since 1940. The dean was also chairman of the society's Barstow Award committee.

Bateman was a member of the Publications Committee of the American Society of Mechanical Engineers and served a year as chairman of its Publications Committee, and was a member of ASME's Advisory Committee on Biography.

He also was a member of the Committee on Abbreviations of the American Standards Association.

Other associations in which the dean was active were the Engineers' Council for Professional Development, the American Society for Engineering Education, and the American Association for the Advancement of Science, of which he was a fellow.

•

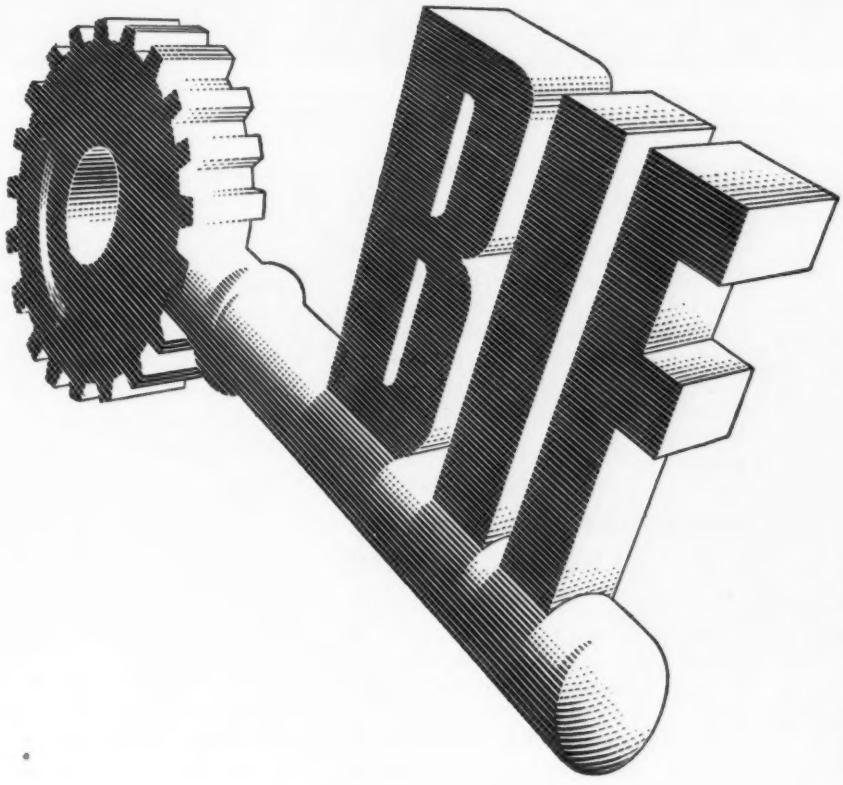
▶ WILLIAM S. CATHERWOOD, JR, 54, general manager of the Metropolitan Device Corp. Brooklyn, died Jan 29 at his home in Brooklyn. He was a nephew of the late Thomas E. Murray, founder of the Murray companies. Before joining Metropolitan, he worked for the New York Edison Co and for a short time was an electrical contractor.

▶ HIRAM G. BYE, 80, died Jan 13 at Youngstown, Ohio, after a long illness. He helped organize the Youngstown Lamp Co which later became the Youngstown Mazda Lamp Co and a branch of the General Electric Co.

▶ MARK B. STEELE, 70, president of the Adams (N. Y.) Electric Light Co, died Feb 3, at his Boca Vista, Fla., home.

LONDON *and* BIRMINGHAM

BRITISH INDUSTRIES FAIR



1948

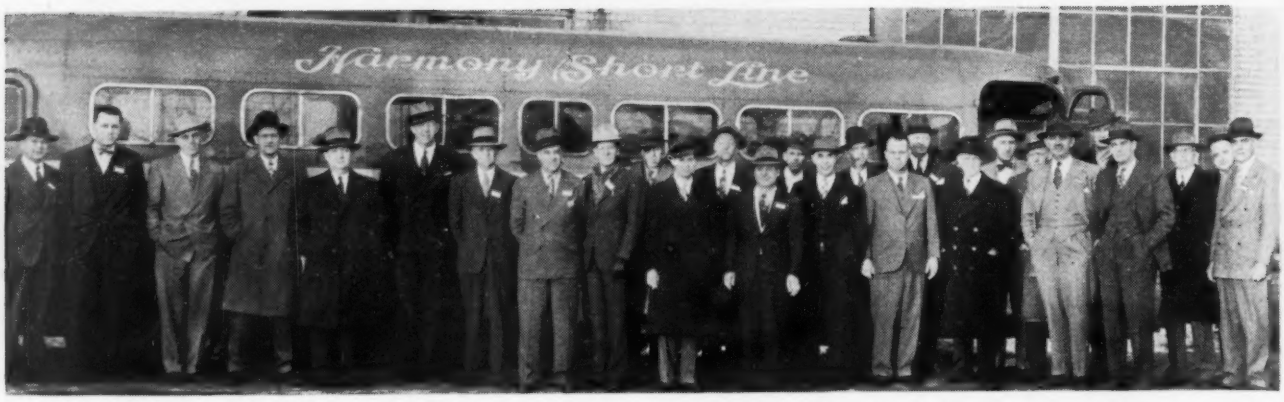
MAY 3-14

ON May 3rd 1948, when the British Industries Fair opens, buyers from all over the world will have an opportunity of inspecting the products of 3,000 United Kingdom manufacturers.

This annual event is the world's largest national trade Fair. Such is its size and importance that you are urged to *come yourself.* You are assured of personal contact with actual manufacturers or sole selling agents and you will find exhibits carefully grouped by trades so that comparisons may be made quickly. Above all you will see new achievements, new methods of manufacture and new ideas all executed with superb craftsmanship.

This is your only opportunity in 1948 to review within a few days the achievements of 87 United Kingdom industries.

For information and assistance you should apply to the nearest British Embassy, Legation or Consulate.



AIEE MEMBERS take time out from winter meeting to visit Railway & Industrial Engineering Co at Greensburg, Pa.

Washington Water Power Buys Elk River System

The Washington Water Power Co, Spokane, has purchased an electrical distribution system and related facilities at Elk River, Ida., formerly owned and operated by the Village of Elk River. Residents of the town voted unanimously for the sale after operating the lines for the past 15 years.

The sales contract, subject to the approval of the Idaho Public Utilities Committee, includes a 25-year franchise. The committee will hold a public hearing on the sale at Boise.

Effective immediately, Washington Water Power announced a 50 percent reduction in rates for Elk River and agreed to make improvements in the entire distribution system as rapidly as possible.

Included in the transaction are transmission lines serving approximately 100 customers and a 22-kv transmission line 22 miles long between Elk River and Bovill, where it feeds into a branch of the Washington Water Power transmission system. Elk River previously has purchased power from Washington Water Power.

This is the third such transaction Washington Water Power has completed in northern Idaho in the last six months, systems at Pierce and Harrison having been purchased last summer.

•

Energy Production Drops

Production of energy by electric utilities during November totaled 21,847,000,000 kwhr, according to the report issued by the Federal Power Commission. This is a drop of 2.2 percent below the previous month's figure of 22,338,103,000 kwhr, which was the highest monthly production of record. Water power plants produced 6,084,051,000 kwhr in November, 3.1 percent below the 6,280,383,000 kwhr production of last November. Industrial production, including generation by railway and railroad plants was 4,332,557,000 kwhr for November, an increase of 8.5 percent over the same month of 1946. Combined utility and industrial production during November was 9.3 percent above Nov 1946 and for the year ended Nov 30 was 13.9 percent above the similar period of the preceding year.

•

Burns & Roe Adopts Group Life Insurance Plan

Burns & Roe, Inc, engineering consultants of New York, N. Y., have announced the adoption of a plan of group life insurance for all full-time employees.

The entire cost of this insurance plan is being borne by the company. All full-time employees who have completed 3 months of continuous service are insured for $1,000; those who have been with the company for 12 months, $2,000; and all who have service records of more than 24 months are insured for $3,000.

Ice and Sleet Storm Hits Lines of Arkansas P&L

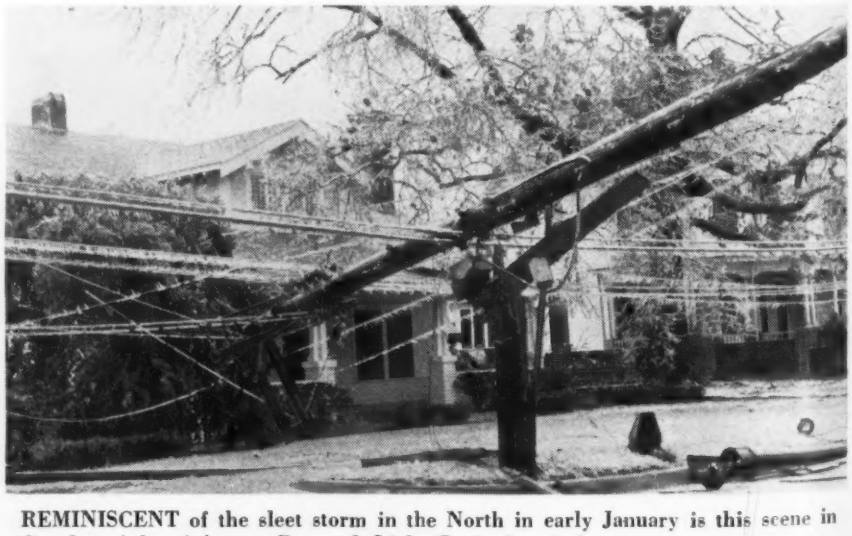
Lines of the Arkansas Power & Light Co were damaged during the last week of January by an ice and sleet storm. Loss has been estimated at close to $250,000. Many communities were out of service for as much as three days.

Hardest hit were Fordyce, Camden, Magnolia, and El Dorado in the company's Southwest Division. Considerable damage was also done in the Southeast Division.

None of the company's major 110-kv transmission lines was down. But countless miles of rural lines and primary and secondary circuits in urban areas were.

Most of the trouble was caused by ice-laden trees and limbs falling across wires. In many cases poles were snapped off near the base because of the heavy weight on the lines.

Crews were rushed to the stricken area from other sections of the state. Contractors building rural lines were also put on the job of restoring service. Since such storms are rare in Arkansas, the repair work posed new problems.

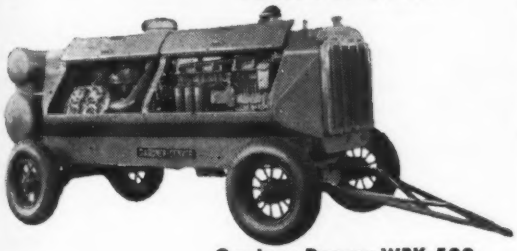


REMINISCENT of the sleet storm in the North in early January is this scene in Camden, Ark. Arkansas Power & Light Co is the victim

HERE'S THE *Quality* LINE

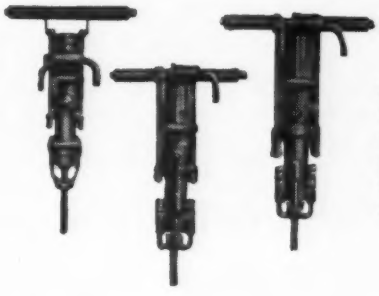
Gardner-Denver WHD-105 Portable Compressor

Gardner-Denver WHF-210 Portable Compressor



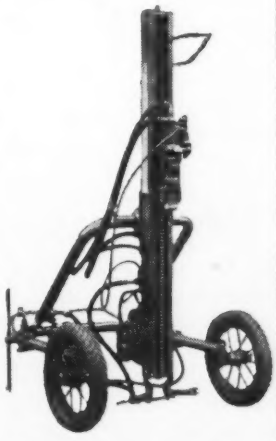
Gardner-Denver WBK-500 Portable Compressor

You're *sure* of an adequate and continuous supply of air when you specify Gardner-Denver Portable Two-stage Water-cooled Air Compressors. *Completely* "water-jacketed" for protection against overheating . . . cold "unlubricated" starts . . . high lubricating oil consumption, Gardner-Denver Portables give you the air you need in any climate or at any altitude. For further information about the complete line of Two-stage Water-cooled Air Compressors, ask for a demonstration or write Gardner-Denver Company, Quincy, Illinois.



No matter what the type of ground, there's a Gardner-Denver Sinker that is "right." Shown from left to right are the S45, the S55 and the S73—part of a complete line of Sinkers available for every need.

T23 Tamper. Balanced for smooth handling, this tamper easily walks over the fill. The plated and polished piston is easy on the front head packing — eliminates loss of power from air leakage. Integral oil reservoir assures complete lubrication.



URM99 Wagon Drill. The *new*, faster drilling motor feed wagon drill. Designed for quicker, 6-foot steel changes; carries a 3½" to 4" bore derrick drill. 5-cylinder radial air motor operates motor feed.

B87 Paving Breaker has an exclusive safety latch that works like the "safety" on a gun—prevents accidents before they start. Operator can move breaker safely from place to place without shutting off air.

GARDNER-DENVER
SINCE 1859

MANUFACTURERS & MARKETS

MILLIONTH MOTOR produced by Jack & Heintz Precision Industries, Inc, Cleveland, is presented by Reber C. Stupp, (second from right) vice-president in charge of production, to Edward R. Legg, (second from left) vice-president in charge of sales. At left is Frank R. Kohnstamm, general sales manager; in center, Harold W. Melampy, superintendent of the Electric Motor Division; at right, Robert J. Ginn, general superintendent of production

Russians Open Exhibit to Show Gains in Electrical Machine Manufacturing

(McGraw-Hill World News)

To feature Russian achievements in electrical machine building, an exhibition has been opened in the Polytechnical Museum in Moscow. Five large halls in the popular technical educational institution are being used.

More than 80 plants of the Soviet Ministry of the Electrical Industry contributed sample products. The exhibit is open to the public. Soviet engineering students also are taken to the exhibit for object lessons in modern electrical appliances.

From scale models, wall charts and diagrams, equipment displays, and specially assigned exhibit guides, the visitors learn of the progress made by Soviet machine builders.

Of major importance are the scale models of modern Soviet-designed turbines and generators. The Soviet hopes to increase total plant capacity by 11,700,000 kw to 22,400,000 kw from 1947 to 1950. The latest product of Soviet turbine builders is shown in scale model. It is a hydrogen-cooled 100,000-kw turbine-generator. It was made at the Elektrosila (Electric Power) Works in Leningrad. The first such unit was completed last year and is now operating in the Moscow system.

An original Soviet-developed system of hydrogen cooling hermetically sealed against leakage has also been developed.

Designers of the new unit are now at work on a 150,000-kw steam unit and a 250,000-kw hydro-generator.

Soviet generator building began in 1923 when four 7,000-kw hydro-generators were built for the Volkhov River Plant. Progress has been rapid, so the Soviet claims. In 1913, Czarist Russia imported 53 percent of its electrical equipment from abroad, and 70 percent of Russian electrical machine-building plants were foreign owned. In 1947, Soviet plants produced 66 times more than the total output in 1913. The largest Soviet plants have developed from branch affiliates of large foreign producers: Dynamo in Moscow from Westinghouse, Elektrosila in Leningrad from Siemens-Schukert.

The exhibit also features Soviet applications of electric power. These include manufacturing machinery and home appliances. Special attention is paid to farm electrification. This is one of the great goals of the Soviet because of the importance of agriculture to the country which still has very low living standards.

•

'47 Appliance Sales Point to Higher '48 Power Sales

A safe prediction to make for 1948 is that the average residential consumer will use a lot more electricity than the estimated 1,435 kwhr he used in 1947. How safe the prediction is becomes apparent when one studies the output of electrical appliances during 1947 as compiled by "Electrical Mechandising."

The appliance manufacturers had a record year. Only sales of a few traffic appliances fell off. The sales of heavy appliances in most cases were more than double those in 1946 and higher than those in any pre-war year. In 1947, it can be assumed also that sales and production were identical. What was made was sold.

Even the comparatively new items, some listed for the first time, showed healthy sales. Electric bed coverings sales were 550,000 in comparison with the 200,000 sold in 1946. Garbage disposer sales were 100,000; television receivers, 165.300; and FM-AM radio receivers, 1,096,900.

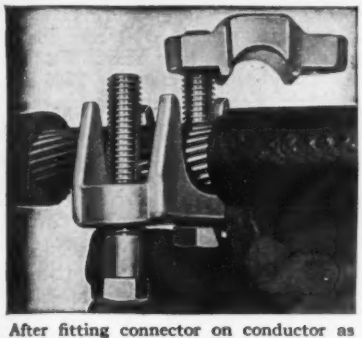
Estimated shipments of lamps were also highest on record. Fluorescent shipments reached 75,600,000 in 1947 as compared with 50,573,000 in 1946. Corresponding figures for large incandescent lamps were 820,000,000 and 714,284,000.

Manufacturers Appliance Sales

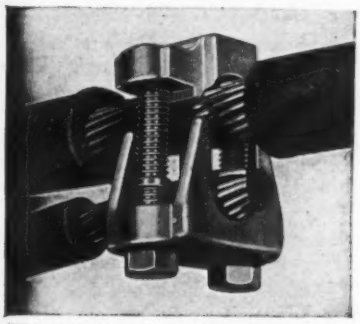
	1947	1946
Cleaners, vacuum	3,704,000	2,289,500
Clocks	9,645,800	6,500,000
Dishwashers	100,000	Not Listed
Dryers, clothes	58,000	Not Listed
Freezers, home	450,000	210,248
Heaters, Radiators	1,865,600	2,000,800
Heating Pads	2,369,000	2,900,000
Hot Plates, Grills	750,000	2,000,000
Ironing Machines	564,000	175,000
Irons	9,400,000	9,600,000
Mixers, food	1,450,000	1,500,000
Oil Burners	750,800	455,218
Radio Receivers AM	15,737,800	13,853,639
Ranges	1,200,800	576,700
Refrigerators	3,400,000	2,100,000
Roasters	340,000	150,000
Toasters	3,700,000	3,500,000
Washing Machines	4,188,000	2,123,900
Water Heaters, storage	1,100,000	488,000

More Efficient Connectors For Large Conductors

Save Up To Half Your Cost

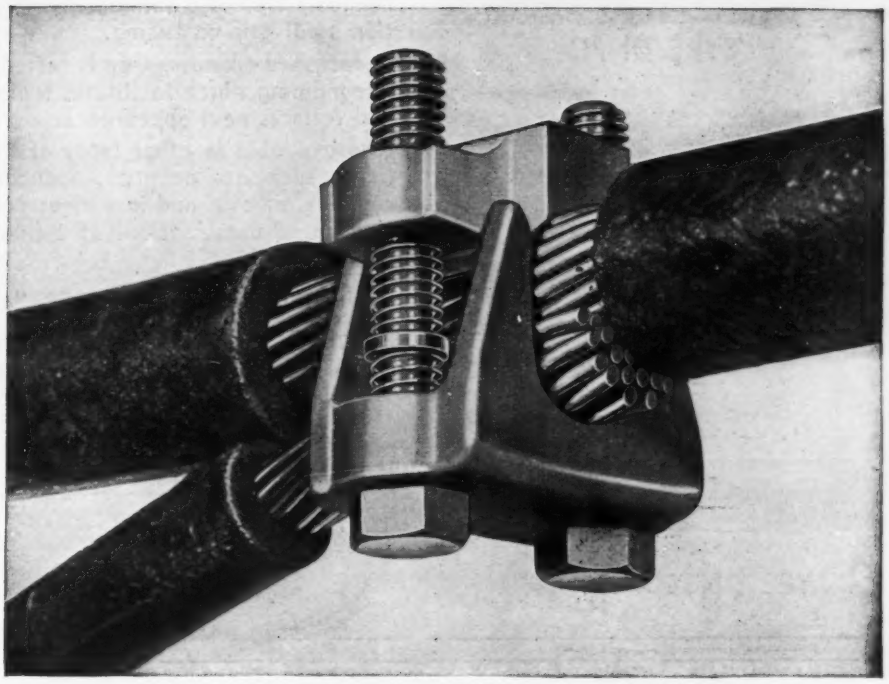


After fitting connector on conductor as above, place upper clamping member in position as shown below and partially thread free cap screw into it.



With connector in position on conductor as shown, install tap-off wire and equally draw up cap screws.

Continue to draw up cap screws until connector is securely tightened. Note easy access of wrench to heads of cap screws.



MATTHEWS UNICLAMP CONNECTORS

U. S. PATENT 2,426,857

You can cut your initial costs on large size wire connections up to 50% by using Matthews Uniclamp Connectors.

You can get them for 1/0, 2/0, 4/0, 350 MCM, 500 MCM and 750 to 1000 MCM stranded copper wire—or 1 ACSR to 1033 MCM ACSR aluminum wire. They can be furnished for copper to copper, aluminum to aluminum, or aluminum to copper and other bi-metal connections. You can install any size with an eight inch wrench and get permanently tight and trouble free connections. They will accommodate two conductors of their rated size or one of rated size with one or more smaller tap-off wires as small as 8 solid. They can also be easily installed by means of hot line tools. You will note the large contact surfaces of the silicon bronze castings and the large strong Duronze cap screws. They are the reasons for better connections; no loosening of connectors; no overheating or burning of connections; less friction due to strong, but small diameter bolts, hence greater pressures on conductors than for corresponding split bolt sizes; they will cost you up to 50% less than comparable sizes of split bolt connectors.

The **one-piece-to-handle** feature is strongly patented and the name Uniclamp is copyrighted. Use genuine Uniclamps and get all the above advantages.

Send in your orders at our risk of your approval.

FOR FURTHER INFORMATION REQUEST BULLETIN 206

W. N. MATTHEWS CORPORATION

3722 FOREST PARK AVENUE ST. LOUIS 8, MO.

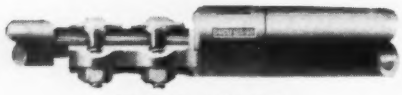
ENGINEERS and MANUFACTURERS SINCE 1899

DOSSERT BOLTLESS CONNECTORS

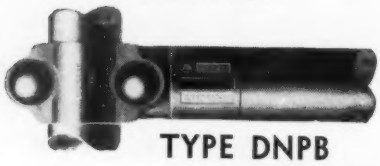
(Patent No. 2198964)

Supplied in various types of connectors embodying the no bolt connector principle

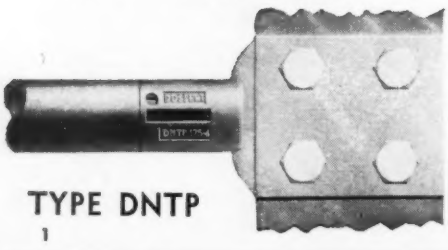
TYPE DNPC



TYPE DNCU



TYPE DNPB



TYPE DNTP

1

Easily and quickly installed.
High pressure, internal-expansion connectors provide permanent, vibration-proof grip on tubing.
Reduces bulkiness, and effects streamlining which facilitates taping and reflects neat appearance.
Also available in other types of fittings, such as: couplers, reducing couplers, elbows, and in various corresponding combinations of tubular bus and cable.

"Insist on a Genuine DOSSERT"

To be sure of a genuine DOSSERT make sure the name DOSSERT is on your connector.

Write for particulars to Dep't 2

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MFG. CORP.
249-255 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904

New **HEAVY-DUTY ELECTRIC PLANT**

5000 WATTS

Only 272 lbs!

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• Large capacity, compact design, and lightweight aluminum construction are combined in this new, rugged, portable electric plant. Easily carried by two men. Powered by Onan 10 HP horizontally-opposed, two-cylinder, 4-cycle, air-cooled engine. Unusual operating economy. Shipped complete, equipped with four-receptacle outlet box and mounted in tubular-steel guard frame.

NEW ONAN CK ELECTRIC PLANTS are available in 5,000 Watts D.C., 115 and 230 volts; 2000 and 3000 Watts A.C. in all standard voltages.

ONAN ELECTRIC PLANTS—*A.C.: 350 to 35,000 Watts in all standard voltages and frequencies. D.C.: 600 to 15,000 Watts, 115 and 230 Volts. Battery Chargers: 500 to 6,000 Watts, 6, 12, 32 and 115 Volts.*

ONAN AIR-COOLED ENGINES—*CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5.5 HP. 1B: 1-cylinder, 3.25 HP.*

Onan PRODUCTS

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D. W. ONAN & SONS INC.
5422 Royalston Ave., Minneapolis 5, Minn.

ONAN ELECTRIC PLANTS

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Railway & Industrial Engineering Co, Greensburg, Pa., has appointed Geeseka & Pinkney, Minneapolis, Minn., as sales representatives to service Minnesota, North Dakota, Northeast South Dakota, Northwestern Wisconsin, and the Upper Peninsula of Michigan. Geeseka & Pinkney also represent I-T-E Circuit Breaker Co, Philadelphia, in the same area.

Wheelco Instrument Co, Chicago, has appointed J. P. Cantor, district manager of the new Cleveland District office, 4501 Prospect Ave. Complete sales, engineering, and service facilities will be available at the new location. Herbert Proske, sales representative has been made assistant district manager at New York. The Washington office has been moved to 2285 Rhode Island Ave. Robert Smith is in charge.

Sheffield Iron & Steel Co, Sheffield, Ala., has appointed William A. Daunt, 110 East 42nd St, New York 17, N. Y., as eastern representative. He will also represent the Consolidated Lamp & Glass Co, Corapolis, Pa.

Hewitt-Robins, Inc, Robins Conveyors Division, has appointed the Galigher Co, 545 West 8th South St, Salt Lake City 4, Utah, exclusive representative for Utah and parts of Idaho, Montana, Nevada, and Wyoming. A new sales office has been opened at 5172 Tracy St, Kansas City, Mo., in charge of C. Boyd Goodhart.

Electromaster, Inc, Mount Clemens, Mich., has appointed Triangle Electric Supply Co, 333 W. San Antonio St, El Paso, Tex., wholesale distributors.

Minneapolis-Honeywell Regulator Co has opened a branch at 1514 E Central, Wichita, Kan. Lynn H. Johnson, Jr, is manager.

Graybar Electric Co has appointed R. W. Kimberlin, district manager at St. Louis.

Brown Instrument Co has opened a district office at 922 Dermon Building, Third and Court Sts, Memphis, Tenn.

Dampney Co of America, Hyde Park, Boston 36, Mass., has appointed the Paxton Co, Norfolk, as distributor for Virginia.

General Electric Co has appointed J. H. MacPhee wiring device representative in the Northeastern District with headquarters at Boston.

Electrical Engineers Equipment Co, Melrose Park, Ill., has appointed Edward Tucker, 702 Union Central Building, Cincinnati, Ohio, representative for Southern Ohio and Eastern Kentucky.

Wilson Welder & Metals Co, Inc, has appointed Industrial Air Products Co, 3200 NW Yeon Ave, Portland 10, Ore., exclusive electrode distributor in Oregon.

•

A-C Employees Cited

Victory and National Defense medals were distributed recently to some 3,000 eligible Allis-Chalmers employees in the Milwaukee area.

"I DID IT . .

I DID IT . . .

I DID IT!"

The hen gives herself a good round of applause every time she lays an egg. And well she might — but she couldn't have done it without that little bit of calcium which forms the shell.

Every time a top engineer sees one of his drawing board dreams breaking a speed or endurance record, he says to himself, "I did it — did it — did it!" — and that does not mean he has laid an egg, either.

But that dream could not have materialized — not good — without that little bit of so-essential Mica. And not real good — if that Mica wasn't Macallen.

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

when you think of MICA, think of MACALLEN

THE MACALLEN COMPANY 16 MACALLEN STREET • BOSTON 27, MASS.
CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.

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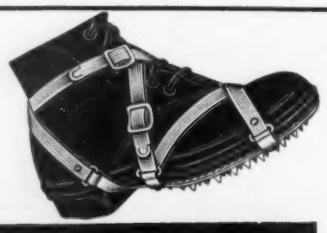
STEEL SOLES

Used by linemen, maintenance crews and highway workers to prevent slipping on icy surfaces.



Tempered spring steel plates, thickly studded with sharp, pointed, case hardened calks. Held securely to foot by reinforced rubber straps

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Safety Equipment for all Industries
INDUSTRIAL PRODUCTS COMPANY
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ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
FROM STOCK
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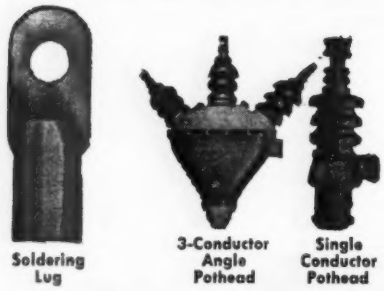

Soldering Lug
3-Conductor Angle Pothead
Single Conductor Pothead

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ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

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RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

California—Pacific Gas & Electric Co., 245 Market St., San Francisco, 2 storage reservoirs with 230,000 acre ft. total capacity at Coolidge Meadows and Helms Creek, 3 power plants and enlarging Blach Plant, a hydro-electric power development project on north fork of Kings River above Pine Flat reservoir site, Fresno Co. **$60,000,000.**

Colorado—Pub. Service Co. of Colorado, 15 and Champa Sts., Denver, electric distr. sys. addns., incl. 80 mi. high voltage transmissions lines, 4 high voltage substations, 3 high voltage substation addns., 8 distr. substations and 12 distr. substation addns., throughout state. **$8,200,000.**

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, furnishing f.o.b. cars at Granby, three 76 in. butterfly valves, and one set assembly and installation equipment; three 88 in. butterfly valves incl. operating units, stop latches and indicator, and one set assembly and installation equipment; one control unit for 88 in. valves and 6 grease guns for the above valves, for Granby Pump. Plant, Colorado - Big Thompson Project, Spec. 2082. W. R. Young, ch. engr.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, two 1,500 kva. and eight 37½ kva. transformers, 4 miscellaneous power distr. boards, 2 reduced-voltage and two magnetic starters, 2 battery chargers, Granby Pumping Plant, Colorado-Big Thompson Proj., Spec. 2062. W. R. Young, Denver, ch. engr.

Colo., Denver—Pub. Service Co. of Colorado, 15 and Champa Sts., 10 story steam power plant known as Arapahoe Plant, on 50 acre plot, W. Vassar Ave. and S. Navajo St. **$14,350,000.**

Florida—Clay Elec. Co-operative, Keystone Heights, 634 mi. rural distr. lines, sys. imprvs. and completion previously approved construction, Clay Co. **$1,250,000.**

Ill., Pittsfield—Illinois Rural Electric Co., Winchester, power plant. Over 100,000. Stanley Eng. Co., Hershey Bldg., Muscatine, Ia., engr.

Ind., Anderson—Bd. P. Wks., E. Coburn, clk., City Hall, surveys municipal power plant imprvs. **$300,000-$400,000. Laramore** & Douglas, 327 S. LaSalle St., Chicago, Ill., consult. engrs. Walter O'Connor, Anderson, city engr.

Iowa—T.I.P. Rural Electric Co-operative, Brooklyn, 284 mi. rural distr. lines, sys. imprvs. and completely previously approved construction, Powesheik Co. **$515,000.**

Mich., Sault Ste. Marie—U. S. Eng., 609 Federal Bldg., Detroit, Zone 31, rein.-con., structural steel, hydro-electric power plant, incl. equip., etc., at St. Marys Falls. Serial No. 20-064-48-72.

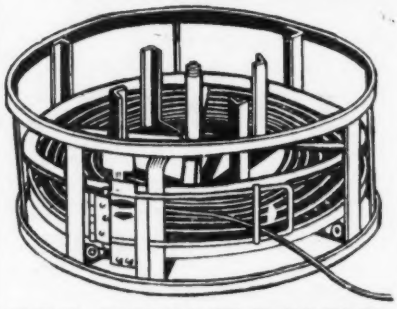
Mo., Independence—City, James Craig, clk., power piping and power station wiring in connection with power plant addn. Black & Veatch, 4706 Broadway, Kansas City, engrs.

Montana—Bureau Reclamation Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., Hungry Horse Dam and Power Plant, dam to be 2,100 ft. long, archgravity, concrete, 520 ft. high rein.-con., power plant housing four 75,000 kw. generators, about 25 mi northeast of Kalispell, Hungry Horse Proj.

Montana—U. S. Eng., Fort Peck, four 12,500/16, 667 kva, 13.8—66.4/115 kv, oil-immersed self-cooled, forced-air, single-phase transformers, and appurtenances for installation in Outdoor Substation Yard at Fort Peck Power Plant, Fort Peck, Serial No. W-24-016-eng-48-43.

N. Y., Albany—Bureau Contracts & Ac-

WIRE CAN'T GET TANGLED OR FOULED



THE WHITAKER
REEL QUICKLY
PAYS FOR ITSELF

Here is an all metal, non-wobble, self-attended WIRE REEL, with automatic brake operated by outgoing wire, accurately adjustable safety pay-out, and take-up.

SENT TO YOU ON 10-DAY FREE TRIAL OFFER!

Ask for No. 1437
Adjustable from 10 to 34 in.

Whitaker also makes small reels for inside wiremen's use.

Write to
WHITAKER REEL MANUFACTURING CO.
P. O. Box 1318 Monroe, Louisiana

All the strength and durability inherent in steel are combined—with definite economies—in Crapo Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of Crapo Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

HAVE YOU A CORROSION PROBLEM ?

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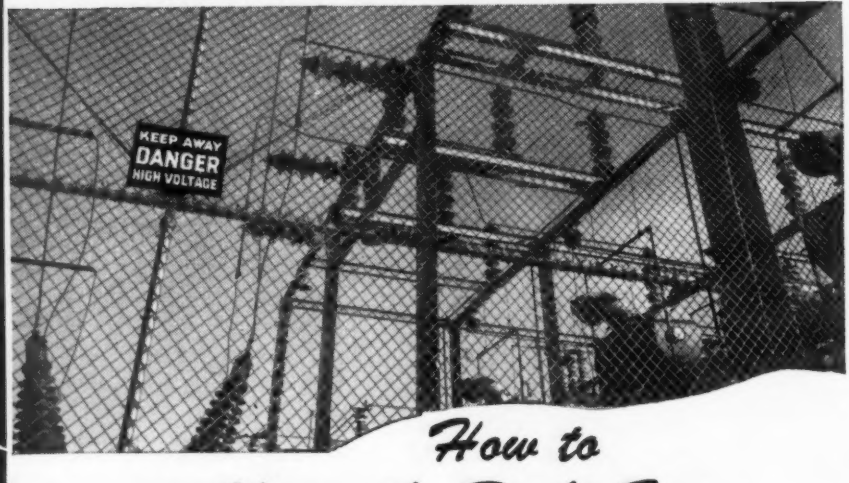

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counts, Albany, power house alterations at Div. Laboratories & Research.

Tex., Houston — Roy Hofheinz, So. Standard Bldg., radio center, Jefferson and Brazos Sts. **$500,000.**

Washington—Bonneville Power Admin., 1300 N. E. Union St., Portland, Ore., 19.5 mi. Olympia-Shelton 115 kv wood pole tranmission line, H-frame wood pole structure with spar-type crossarms. Plans deposit $25.

Wash., Tacoma—City, City Hall, transmission line from LaGrande to Tideflats substation. **$1,476,000.** J. F. Ward, city light supt.

Wisconsin—Wisconsin Public Service Corp., Bellen Bldg., Green Bay, transmission line between Stevens Point and Petenwell hydro-elect plant. **$412,000.** A. G. Carson, c/o owner, engr.

Low Bidders & Contracts Awarded

Ala., Mobile—Radio Station WALA, c/o Harry Inge Johnstone, archt., 1009 Dauphin St., radio station, to E. L. Morrow Constr. Co., c/o archt. Est. **$100,000.**

Fla., Jacksonville — City, furnishing three 37,500 kva. transformers and two sets spare parts for same—part of equipment for new fifteen million dollar Power Plant 2, from General Electric Co., 1 River Rd., Schenectady, N. Y. **$259,702.** Reynolds Smith & Hills, 227 Park Ave., engrs.

Fla., Orlando—Orlando Utilities Comn., Orlando, water and power plant, structural work, to Ivy H. Smith Co., 1525 San Marco Blvd., Jacksonville, **$961,000*****power plant piping, to Pittsburgh Pipe & Equipment Co., c/o owner, **$379,000*****water plant piping, to A. H. Guion & Co., Wilkinson Blvd., Charlotte, N. C., **$191,000*****electrical work to Satchwell & Joseph, c/o owner, **$261,000*****stacks, to J. J. Finnigan Co., 455 Means St., N. W., Atlanta, Ga., **$43,000.** Grand total $1,835,000. Bids 1/27.

Missouri—Consolidated Electric Co-operative, Mexico, 261 mi. rural distr. lines serving Audrain, Monroe, Montgomery and Pike Counties, 70 mi. addns., to existing lines. Own forces. **$565,000.**

Tex., San Antonio—City Public Service Bd., 201 N. St. Marys St., transformer unit, **$185,000;** electric power substation, Northwest side, **$205,600,** force account.

Va., Langley Field—National Advisory Com. for Aeronautics, 4x4 ft. supersonic tunnel, modifications, alterations, extens., to Tuller Constr. Co., Red Bank, N. J. **$623,000.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Del., Wilmington—U. S. Eng., 1400 Penn Mutual Bldg., Phila. 1, Pa., hospital for Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash. 25, D. C. $4,950,000. L. H. Doane, Penna Bldg., engr. Massena & Du Pont, 704 Delaware Ave., archts.

N. J., Newark—Syndicate, c/o Albert M. Greenfield & Co., 17 Academy St., apartment hotel, airline terminal and underground garage, Raymond Blvd. near Pennsylvania Station. **$5,000,000.**

N. M., Albuquerque—Veterans Admin., c/o A. F. Lafgren, ch. Construction Div., P. O. Box 1200, Denver, Colo., addn. to 250 bed Veterans Hospital. **$4,500,000.**

Tex., Dallas — Asch-Abel Constr. Co., Inc., Construction Bldg., 160 unit masonry apartment, Prestonville area off NW Fly. **$1,300,000.**

Wis., Darlington—Lafayette County Memorial Hospital, Darlington, hospital. **$500,000.**

Low Bidders & Contracts Awarded

Neb., Omaha—U. S. Eng., 1709 Jackson St., Zone 2, 500-bed veterans hospital, incl. main bldg., 2 auxiliary bldgs., roads, walks and utilities, Serial No. 25-066-47-299, for Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash. 25, D. C., to Peter Kiewit & Assoc., 1024 Omaha Natl. Bank Bldg., Omaha, Olson & Johnson and Charles H. Tompkins Co., 907 16 St. N. W., Wash., D. C., and Morrison & Knudsen, 319 Broadway, Boise, Idaho. **$9,818,400.**

Pa., Saxonburg—Carnegie Institute of Technology, Schenley Park, Pittsburgh, 1 story L shaped, steel, brick cyclotron bldg., to Crump, Inc., 4031 Bigelow Blvd., Pittsburgh. Est. **$1,000,000** incl. equip. Fisher & Schmertz, Century Bldg., Pittsburgh, archts.

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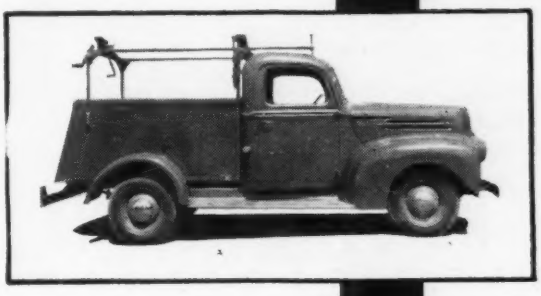

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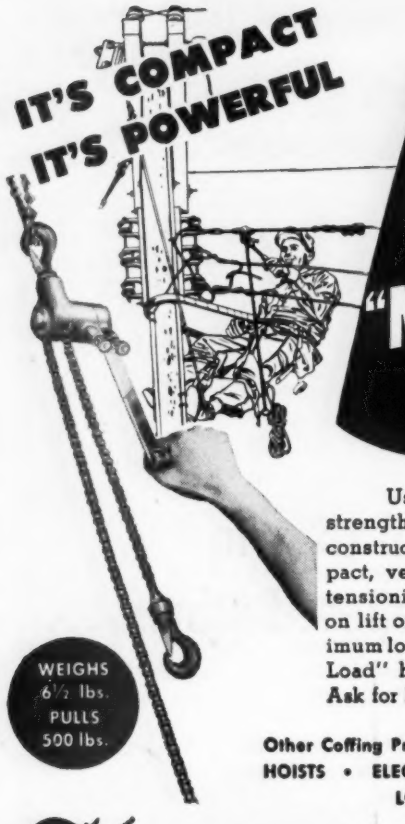

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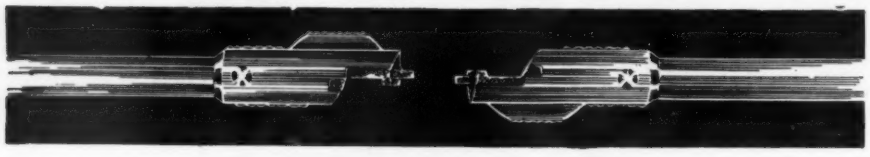

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● CONNECTORS: Booklet "Connector Selector" is available with index for quick selection of terminals, taps, T-connectors and splices. Burndy Engineering Co, 107 Bruckner Blvd, New York 54, N. Y.

● CABLES: A 14-page booklet carries descriptions and a selector of various kinds of wires and cables with insulation for 18 services. Simplex Wire & Cable Co, 79 Sidney St, Cambridge, Mass.

● REGULATORS: Self-cooled, 60-cycle, outdoor feeder voltage regulators, type AFR, built in standard ratings of plus or minus 10 percent load ratio control in thirty-two 5/8 percent steps, are described in a 24-page bulletin. Allis-Chalmers Mfg Co, 1126 South 70th St, Milwaukee 1, Wis.

● U. G. MATERIALS: Bulletin 46031 describes, illustrates and groups related construction material items from asbestos tape and fiber conduit to transformers, potheads and wire lugs for underground distribution systems. Line Material Co, 800 North Eighth St, Milwaukee 1, Wis.

● GENERATORS: "How to Apply Regulectric A-C Generators" with seven tables for generator and wire selection is published in SYNCHRONIZER, Vol. 1, No. 3a. Electric Machinery Mfg Co, 821 Second Ave, Minneapolis 14, Minn.

● LIGHTING: Photometric data and layout information are given in Catalog 48 showing fluorescent and incandescent lighting equipment for schools, offices, drafting rooms and stores. F. W. Wakefield Brass Co, 731 West River St, Vermilion, Ohio.

● FARMS: Purpose of "Modern Farm Help" (GEA-4547) is to relate and illustrate practical and profitable uses of electricity outside the farm home (or in farm production operation) by farm people. General Electric Co, 1 River Road, Schenectady 5, N. Y.

● CABLE DEVICES: A 72-page bulletin (No. 172) lists standard sizes, forms, dimensions of potheads, cable boxes, oil fuse cutouts and oil switches. Special forms are mentioned and available. G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

● INSTRUMENTS: Bulletin 19-48 presents brief descriptions and outlines applications of insulation and resistance testers, resonant-reed frequency meters, resonant-reed and hand tachometers and speed indicators. James G. Biddle Co, 1316 Arch St, Philadelphia 17, Pa.

● CONTROL: Publication 3012 describes and illustrates a monitor for automatic, frequent and regular temperature checking at selected locations in mechanisms. Thomas A. Edison, Inc, Main St, West Orange, N. Y.

● CAPACITORS: Catalog No. 200 carries a description of more than 20 different classes of capacitors such as the dry electrolytic and paper types. Cornell-Dubilier Electric Corp, 1019 Hamilton Blvd, South Plainfield, N. J.

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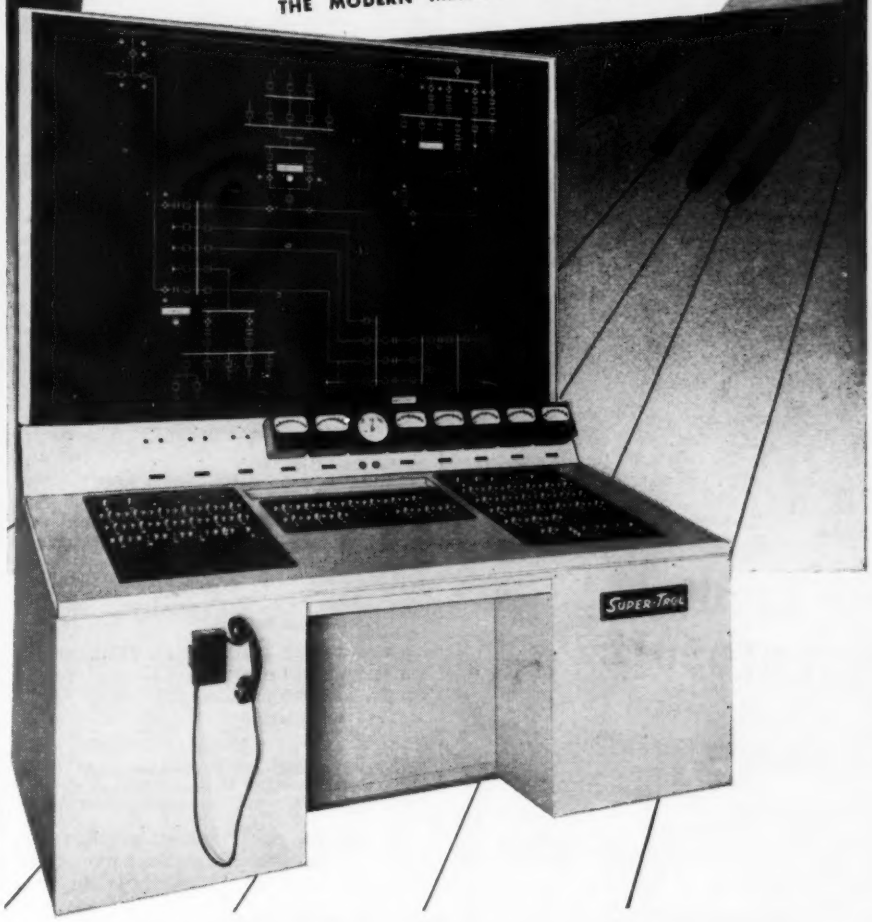

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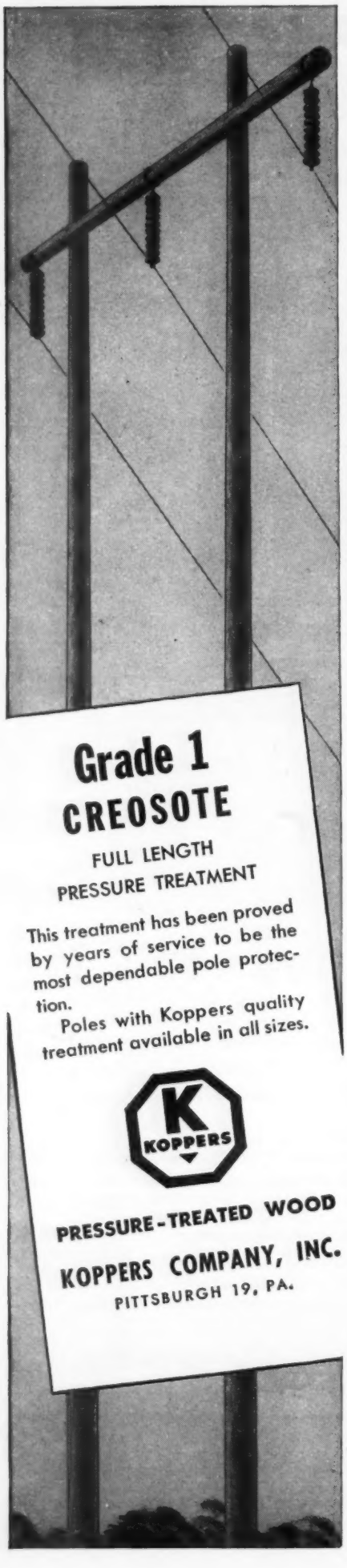

BOOK REVIEWS

Sunspots in Action. **By H. T. Stetson. Published by the Ronald Press Co, New York. 252 pages, illustrated. Price $3.50.**

Power companies are interested in weather, rainfall, radio communication and the general level of business activity. This noted astronomer relates each of these phenomena to sunspot activity and does it in lay language readily grasped by engineer, hydrologist and economist alike. Again, those interested in nucleonics will find the turbulences of the sun identified in some degree with the phenomena of fission. Lucid explanation is given of FM skip-distance anomalies, of the aurora, of the Easter 1940 earth currents and interference with telegraphy. For those prone to do forecasting there is systematic data about the sunspot cycles as far back as 1750—some 18 peaks in 195 years.

Introduction To Electrical Engineering. **By Robert Page Ward. Published by Prentice-Hall Inc, New York. 370 pages, illustrated. Price $6.35.**

Material for this elementary text formed the basis for an introductory course in electrical engineering for first semester sophomore students at the Agricultural and Mechanical College of Texas. Intended for students taking parallel courses in calculus and physics, the mathematics is limited in early chapters to algebra and trigonometry. Derivations using calculus have been relegated to footnotes for students not taking that subject. An elementary discussion of electrochemistry and an introduction to such electronic fundamentals as thermonic emission, space charge and the behavior of the basic electron tubes are treated in the last two chapters.

Technique of Microwave Measurements. **Edited by C. G. Montgomery, McGraw-Hill Book Co, Inc, New York. 939 pages, illustrated. Price $10.**

This is an M.I.T. Radiation Laboratory Series book, published as part of the National Defense Research Committee (OSRD) program. Use of microwaves as an adjunct to power system operations is more conjectural than imminent, but it is being discussed. Against that day, here is an authoritative treatment of the bridge, bolometer, barretter, thermistor and waterload methods of basic circuit measurement of microwave quantities. Those familiar with orthodox procedures for power frequencies will be intrigued by the refinements and transformations required. More important from the standpoint of possible use of microwaves for relay purposes are the techniques detailed for determining frequency, pulse shape, spectrum distribution, phase displacement, amplitude and attenuation.

Nomography. **By A. S. Levens. Published by John Wiley & Sons, Inc, New York 16, 176 pages, illustrated. Price $3.**

Technique of designing nomograms is, in this book, based on algebra and geometry with secondary reliance on the determinant procedure emphasized in many other books on the subject. Further than that, the treatment moves consistently and lucidly from the simplest examples after showing the limitations of the Cartesian plots. In addition to the numerous nomograms developed in full detail, there are 124 exer-

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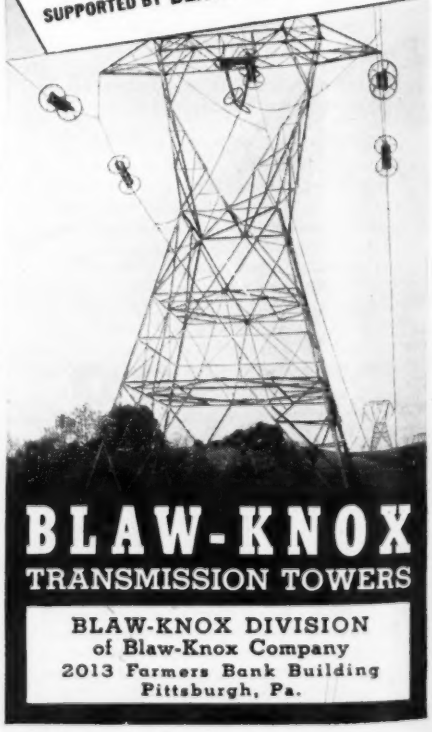

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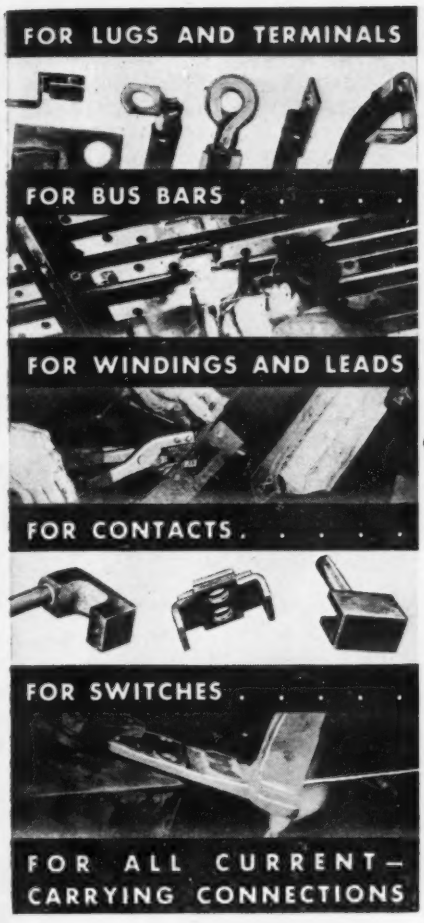
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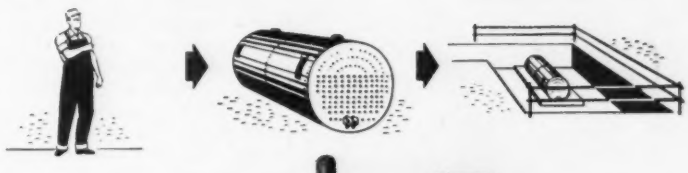

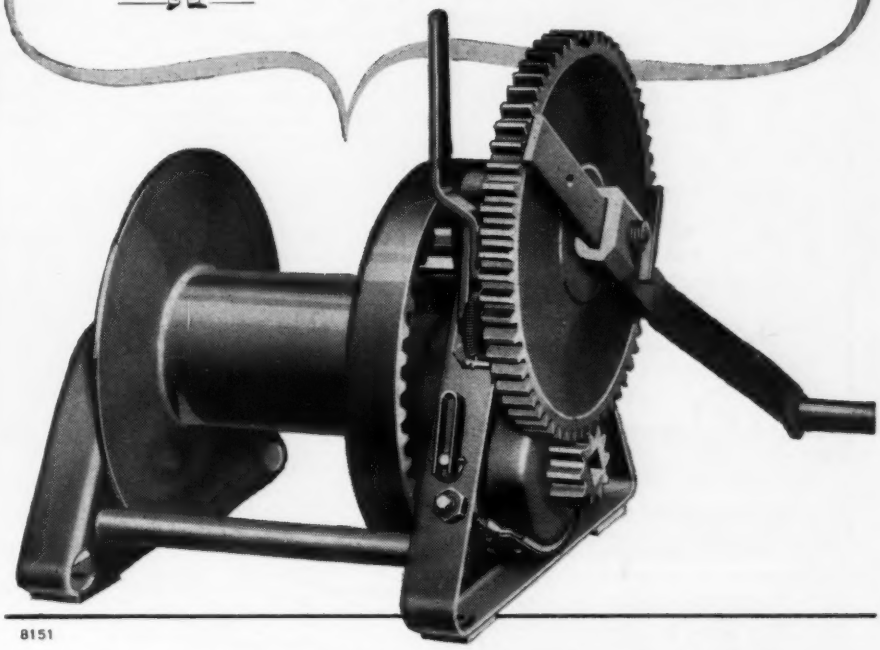

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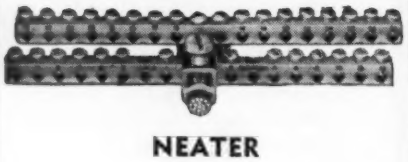

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Troubles of Electrical Equipment. **By H. E. Stafford. Published by McGraw-Hill Book Co, New York. 455 pages, illustrated. Price $4.50.**

This is a third edition presenting extensive improvements and new material in the form of added chapters, formulas, tables and diagrams. There has been no departure from the original intention to help the engineer and operator to diagnose the symptoms, identify the difficulties and apply logical remedies. Equipment covered in tangibly helpful detail embraces motors, generators, transformers, circuit breakers, relays, controls, cables and batteries. Other chapters discuss insulation tests, power factor and the orderly scheduling of maintenance.

Electric Distribution Fundamentals. **By Frank E. Sanford. Published by McGraw-Hill Book Co, New York. Second edition, 252 pages, illustrated. Price $3.50**

The second edition of this practical book on the basic principles of electric distribution system design incorporates two principal changes. First, the explanation of vector addition has been expanded to include the trigonometric method of calculation. While retaining the intent of serving readers not familiar with advanced mathematics, this expansion will also help young engineers in applying more exact mathematical solutions to distribution design problems. Second, a new chapter has been added to enlarge on the subject of transformer operation. In it is included a summary of load characteristics and load determination methods.

Principles and Practice of Electrical Engineering. **By Alexander Gray (Revised by G. A. Wallace). Published by McGraw-Hill Co. 568 pages, illustrated. Price $4.50.**

Six editions have now appeared since the first in 1914. Each has coupled significant prevailing practice with simply presented principles. This one puts more emphasis on polyphase systems and apparatus as well as modernizing the treatment of the transformer. Added subject matter deals with electronics, fluorescents, rotary amplifiers and mercury rectifiers. D-c and a-c are combined in a single volume of beginners' level.

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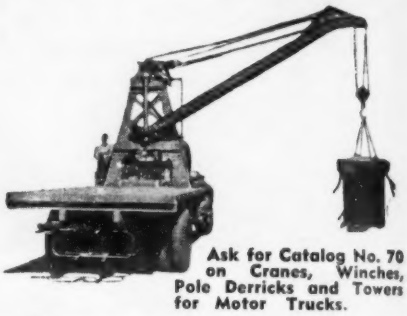

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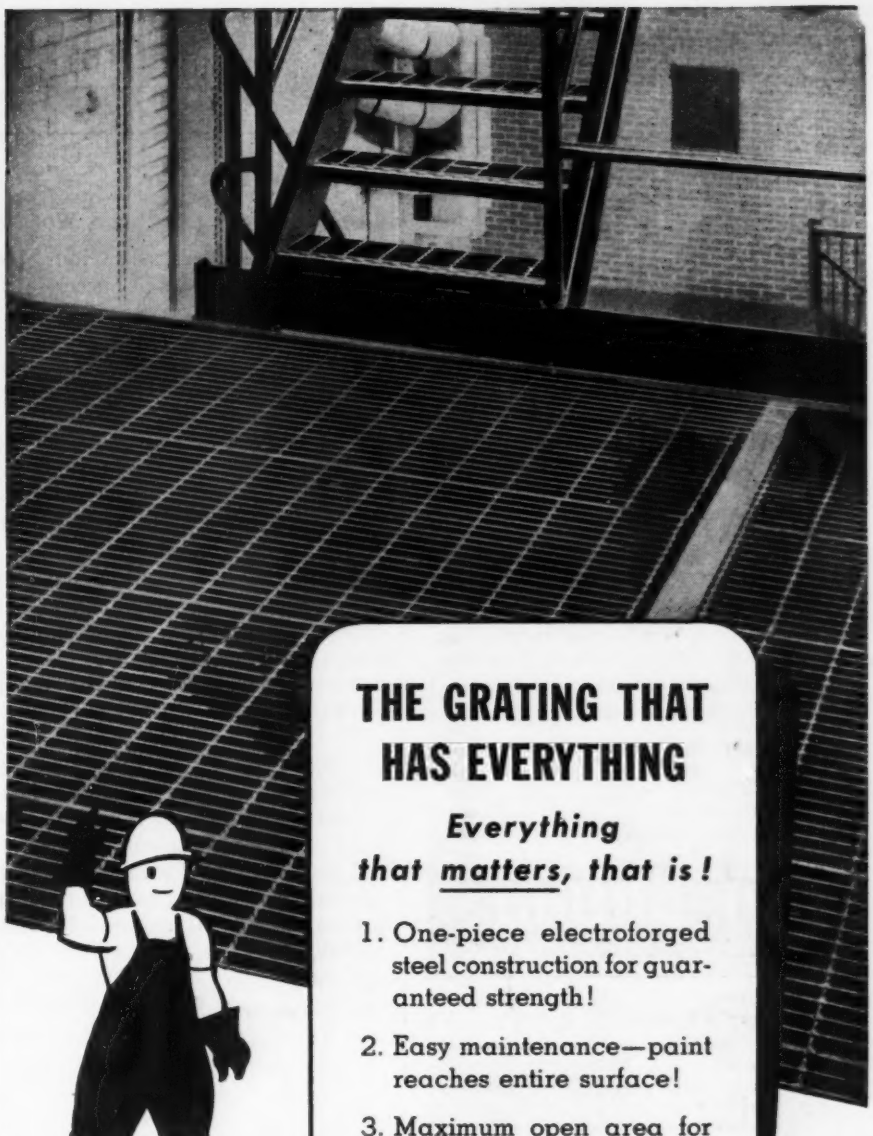

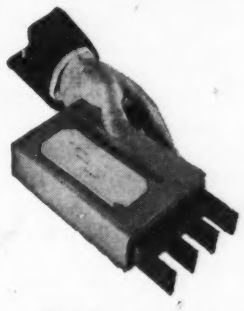

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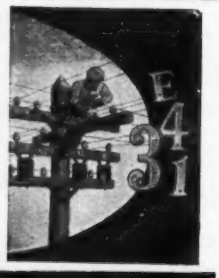

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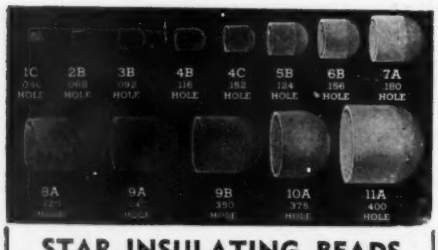

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LETTERS TO THE EDITOR

Scout Twice a Year

To the Editor of ELECTRICAL WORLD:

I was quite interested in your recent article, "Prerequisites to Successful Recruiting," in the Nov 8 issue of ELECTRICAL WORLD.

In Table V, you suggest that the personnel man should visit the colleges not later than mid-spring. You are probably thinking in pre-war terms when our colleges graduated their seniors in May or June. At the present time, we still have a large number of students graduating in January or February, because freshmen start twice each year (spring and fall) and, accordingly, there are two commencements each year. I have reason to believe that this situation will continue for another three or four years.

Therefore, the personnel man should visit the colleges not only in mid-spring, in order to recruit the June graduates, but also in October or November in order to recruit the January graduates.

I hope that these ideas will help the power industry to get more of the better graduates whom they need in larger quantities.

Eric T. B. Gross
Professor of Electrical Engineering
Illinois Institute of Technology
Chicago

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No-Cost Energy for House Heating

To the Editor of ELECTRICAL WORLD:

Noting the article in the ELECTRICAL WORLD of October 11, 1947, on electric heating by Mr A. W. Ames, Seattle City Light, I would like to comment on his conclusions which, while correct on the premise on which the tests were based, I believe are in error in view of recent developments in the field of electrical space heating.

The heating of homes by electricity in Seattle, as is the usual case elsewhere, is based on the use of some form of electric heater energized as required by the room thermostat to maintain the desired temperature. This means, of course, as Mr Ames points out, a low yearly load factor and a heating demand coincident with other domestic loads. This demand is completely additive to station generation, except for diversity among the individual homes, thus making a net demand on station peak of about 10 kw per unit, as Mr Ames has determined.

Apparently no consideration has been given to the development of off-peak

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electric heating. It is perfectly feasible to carry a residential heating load which will not be additive to station peaks, and which can be under the control of the load dispatcher in such a way as to supply heating energy without either making secondary peaks or adding to the principal peak. Proper design of radiant installations with suitable controls makes it perfectly feasible to heat 50 homes of the size indicated in Mr Ames' article for each 1,000 kw of system load at time of peak without increasing the peak. This means that at the wholesale rate of $17.50 per kw-year, house heating could be supplied practically without cost to the utility, except for such expense as might be incurred by strengthening the distribution system.

R. W. Shoemaker
Consulting Engineer
Oakland, Calif.

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Underwriters Approved

To the Editor of ELECTRICAL WORLD:

Today more than ever before, city ordinances are restricting the sale of electric appliances and devices by requiring that they must have Underwriters Approval. Practically all manufacturers who have the safety of the public at heart have submitted their products for approval.

This procedure is acknowledged today among the trade and engineers as the most satisfactory method to achieve control and elimination of inferior and substandard electric devices.

Your organization might take the lead in another step for progress by urging and checking with advertisers to see that all their copy state whether it has Underwriters Approval. This would assist the dealer, engineer, purchasing agent, and public in making their selection. The failure of a manufacturer to so state when he can truthfully do so is either an oversight or he just doesn't understand how important it is to a large group.

It is rather discouraging to have to dig up the published list of The Underwriters every time you want to buy something. Sometimes failure to do so draws a call from the City Electrical Inspector advising that you can't sell the item in this city because it isn't Approved.

Is this sort of promotional activity tabooed because of a few unethical technicalities? Do we dare or don't we for business reasons?

Yours very truly
Howard G. Plank
Manitowoc, Wis.

(ELECTRICAL WORLD heartedly endorses the suggestion advanced by Electrical Engineer Plank, of the Manitowoc Public Utilities.)

PAGE

Stainless Steel

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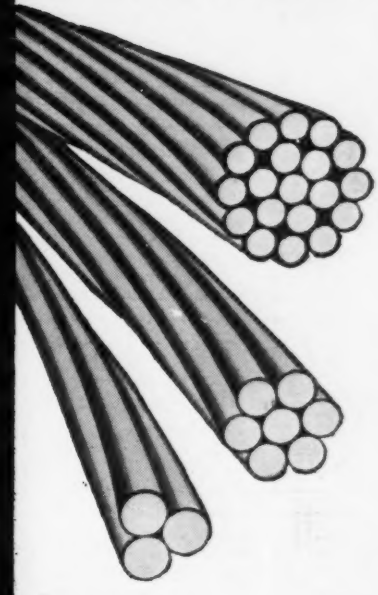

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